

PEONIES *of the World*

TAXONOMY AND PHYTOGEOGRAPHY

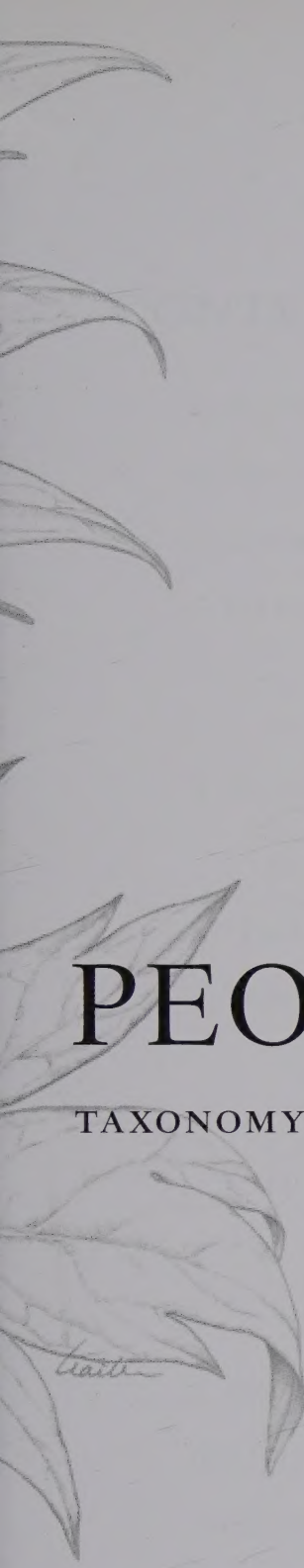
HONG De-Yuan

The genus *Paeonia*, known as 'The Queen of Herbs' and 'The King of Flowers', has been one of the most important and popular groups of plants for millennia, coveted in the East and West alike for both ornamental and medicinal purposes. This new monograph, recognising 32 species, is a comprehensive taxonomic revision, based on extensive field observations, population sampling, examination of more than 5,000 herbarium specimens, and statistical analysis of characters. Keys to sections, subsections, species, and subspecies are presented. Detailed descriptions of each species are illustrated with 78 elegant line drawings showing key characteristics, and 39 maps clearly show the distribution of each species. Importantly, the book describes the methodology and principles on which this scholarly taxonomic revision was based. This is an essential book for plant taxonomists, horticulturists, and more adventurous gardeners.

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HONG De-Yuan

IN ASSOCIATION WITH

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Kew Publishing
Royal Botanic Gardens, Kew

Missouri Botanical Garden
St. Louis

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First published in 2010 by
Royal Botanic Gardens, Kew,
Richmond, Surrey, TW9 3AB, UK
www.kew.org

ISBN 978-1-84246-392-5

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Production editor: Sharon Whitehead
Typesetting and page layout: Christine Beard
Publishing, Design & Photography, Royal Botanic Gardens, Kew

Cover design: Lyn Davies Design

Printed in the United Kingdom by Henry Ling Limited



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CONTENTS

SYNOPSIS	vi
PREFACE	vii
ACKNOWLEDGEMENTS	ix
1. INTRODUCTION	1
1.1 Course of the work contributing to this monograph	1
1.2 Methodology	6
1.3 Principles of taxonomic treatment	8
2. HISTORY OF TAXONOMIC STUDIES OF PAEONIA	11
2.1 Brief review of the taxonomic history of <i>Paeonia</i> since Linnaeus (1753)	11
2.2 Commentary on the taxonomic history of <i>Paeonia</i>	21
3. CHARACTERS AND THEIR VARIATIONS	29
4. TAXONOMIC SYNOPSIS OF THE GENUS PAEONIA	49
I. <i>Paeonia</i> sect. <i>Moutan</i> DC.	50
Ia. <i>Paeonia</i> subsect. <i>Delavayanae</i> Stern (species 1, 2)	52
Ib. <i>Paeonia</i> subsect. <i>Vaginatae</i> Stern (species 3–8)	53
II. <i>Paeonia</i> sect. <i>Onaepia</i> Lindl. (species 9, 10)	53
III. <i>Paeonia</i> sect. <i>Paeonia</i>	54
Subdivisions of sect. <i>Paeonia</i>	
IIIa. <i>Paeonia</i> subsect. <i>Albiflorae</i> (Salm-Dyck) D. Y. Hong (species 11–14)	57
IIIb. <i>Paeonia</i> subsect. <i>Foliolatae</i> Stern (species 15–25)	57
IIIc. <i>Paeonia</i> subsect. <i>Paeonia</i> (species 26–32)	58
5. DESCRIPTIONS OF SPECIES	61
BIBLIOGRAPHY	245
INDEX TO BOTANICAL NAMES IN PAEONIA	259
AUTHORS OF BOTANICAL NAMES	271
HERBARIA VISITED OR WITH SPECIMENS ON LOAN	275
HERBARIUM SPECIMENS EXAMINED AND THEIR SPECIES DESIGNATIONS	277

SYNOPSIS

The present monograph presents a taxonomic revision of the genus *Paeonia* based on extensive field observations, population sampling, and statistical analysis of various characters. All specimens available from 65 herbaria were examined and identified, and thus there is a list of herbarium specimens examined and their species designations. The monograph recognises three sections, sect. *moutan* DC., sect. *Onaepia* Lindl. and sect. *Paeonia*. Two subsections are recognised in sect. *Moutan*: subsect. *Delavayanae* Stern and subsect. *Vaginatae* Stern. I recognise three subsections in sect. *Paeonia*: subsect. *Paeonia*, subsect. *Albiflorae* (Salm-Dyck) D. Y. Hong, and subsect. *Foliolatae* Stern. The subsection *Albiflorae* (Salm-Dyck) D. Y. Hong is a new status of sect. *Albiflorae* Salm-Dyck (1834). Thirty-two species and 26 subspecies of wild peonies are recognized in the monograph, including a new subspecies from Croatia, *Paeonia daurica* Andrews subsp. *velebitensis* D. Y. Hong. Each species is described, its distribution is mapped, and its relationships with other species are discussed in detail. The monograph reports 23 chromosome countings, including five new records: *Paeonia intermedia* C. A. Mey. ($2n=10$), *P. qini* Y. L. Pei & D. Y. Hong ($2n = 10$), *P. sterniana* H. R. Fletcher ($2n = 10$), *P. rockii* subsp. *rockii* ($2n = 10$), and a new chromosome number for *P. emodi* Wall. ex Royle ($2n = 20$). The monograph contains six colour plates, three black and white plates, 78 line drawings of plants, and 39 maps. Twelve lectotypes and 17 neotypes are newly designated, and more than 40 taxa are reduced as synonymy (syn. nov.).

PREFACE

My monograph on the genus *Paeonia* will comprise three parts. This book, covering taxonomy and phytogeography, is the first. The second will illustrate the polymorphism and diversity within the genus with colour photographs taken in the field, accompanied by short descriptions; and the third will deal with phylogeny and evolution.

In the summer of 1984, DAI Lung-Kai, chief officer of the Research Department at the Institute of Botany, the Chinese Academy of Sciences, informed me that I should put forward a proposal for a project to be funded by a generous grant of 50,000 RMB from the Chinese Academy of Sciences. The grant was especially for scholars returned from overseas, and I had been a visiting scholar in Sweden from 1979 to 1981.

In choosing my subject, I wished to reflect a combination of academic and public interests, and I had already been thinking about the genus *Paeonia*. My wife, PAN Kai-Yu, a botanist and author of *Paeonia for Flora Reipublicae Popularis Sinicae* (Vol. 27, 1979), encouraged me to study this interesting group.

The genus *Paeonia* has been culturally significant in both the East and West for millennia. Tree peony has long been called 'King of Flowers' in China, and the herbaceous peony was called 'Queen of Herbs' in ancient Greece.

Systematically, the genus *Paeonia* is isolated from other groups of angiosperms in many respects; for example, its embryogenesis involves the existence of a free nuclei stage, the coenocytic proembryo, it contains unique chemical compounds, e.g. paeoniflorin, its anthroecia undergo centrifugal development, and chromosome behaviour at meiosis shows permanent structural hybridity.

The origin of the cultivated tree peony, whose wild relatives are all endemic to China, also struck us as worthy of investigation.

My work on *Paeonia* started in the spring of 1985, when I collected materials for cytotaxonomy in Sichuan, Shaanxi and Hebei provinces with assistance from ZHU Xian-Yun. This work was published in two papers: Hong *et al.* 1988 and Hong 1989.

Three events that bolstered the *Paeonia* project took place shortly afterwards. First, in 1990, Peter Raven, president of the Missouri Botanical Garden, encouraged me to increase my focus on *Paeonia* when I mentioned it as one of several projects in our laboratory.

Second, in 1991, Tao SANG (now at Michigan State University) sought my advice on whether he should take *Paeonia* as the subject of the dissertation project for his Ph.D (at Ohio State University). I suggested that we divide the work: he should work on molecular systematics and evolution while I continued to work on taxonomy, mainly based on morphology. Since then, we have been in successful collaboration.

Third, Dr Wilhelm Sauer invited me and my wife to work at Tübingen University in Germany for three months, starting in November 1991. He kindly borrowed for us thousands of *Paeonia* specimens from a number of major European herbaria.

Readers will readily note differences in the number of species recognised and their circumscriptions when comparing the present work with previous monographs or revisions of *Paeonia*. Baker (1884) recognised 22 species, of which only eight are identical or partly identical to those described in this monograph. Lynch (1890) described 25 species, but only six correspond with those described in this work. Huth (1891) recognised 14 species, of which again only six agree with my taxa/taxonomic view. Stern's (1946) monograph of the genus *Paeonia* has been the most widely

accepted work and still has a significant influence. He recognised 33 species, with only 19 corresponding with the 32 species in this monograph in both name and circumscription. Halda (2004) recognised 25 species, of which only 12 agree with my work.

The differences, as readers will realise from the first chapter of this book, arise from the principles and practices of taxonomy. A rational classification must be based on the biology of plant groups. To fully understand the variation of characters, their patterns and ranges, the population concept is crucial. With these principles in mind, our practices included:

- 1) extensive field observations and population sampling;
- 2) critical examination of all available herbarium specimens;
- 3) statistical analysis; and
- 4) examination of as many type specimens as possible.

I have found that many of the characters emphasised by previous authors are continuously variable or polymorphic, and thus less significant in the taxonomy of *Paeonia* (Haw, 2001a, 2001b; see Chapter 3). I have also found that a number of characters neglected by previous authors — for example, the shape of roots, the shape of involucre bracts and sepals, and the number and pattern of leaflets or the segmentation of lower leaves — are valuable for taxonomy in *Paeonia* (see Chapter 3).

Parts of this taxonomic revision of *Paeonia* have been reinforced by later workers. My treatment of tree peonies (*Paeonia* sect. *Moutan* DC.) (Hong & Pan, 1999a, 1999b) has been confirmed (Zou *et al.*, 1999) or essentially confirmed (Zhao *et al.*, 2004), and has been accepted by Haw (2001a, 2001b) and Cheng (2005).

ACKNOWLEDGEMENTS

This monograph would not have been possible without the help of others.

I must first thank the National Geographic Society for five grants that were crucial to our work. My gratitude also goes to the Chinese Academy of Sciences for the financial support that allowed me to start this fascinating project.

For more than 10 years, Dr P. Raven, president of the Missouri Botanical Garden, has encouraged and supported me, giving very valuable suggestions.

Dr W. Sauer, professor at Tübingen University before his retirement, offered an unexpected opportunity to examine thousands of herbarium specimens borrowed from several large European herbaria in 1991. Dr Sauer also generously gave me three specimens of *Paeonia* collected by himself and his wife, Gerda Sauer, in the Balkans, which led to the description of a new species, *P. saueri*, which is named after them.

The English of the first four chapters has been much improved by Miss P. Woodward and Dr J. W. Waddick. Dr I. Al-Shehbaz at the Missouri Botanical Garden helped me in a number of ways, with valuable suggestions and assistance in the publication of three articles. The late Dr G. H. Zhu helped me in searching for literature in the library of the Missouri Botanical Garden. Dr A. Brach of Harvard University also provided many valuable references.

Dr YU Hong from Yunnan University organised both our expedition to NW Yunnan Province in 1997, for which we were joined by Prof. GU Hong-Ya from Peking University, and our expedition to NE Yunnan in 2004. Prof. LI Xue-Yu from Shihezi University in Xinjiang, organised our expedition to the Tianshan and Altai mountains in 1993, for which we were joined by Dr T. Sang from Ohio State University and Prof. ZHANG Zi-Yu from the Second Military Medical University in Shanghai. In our expeditions to Xizang (Tibet) in 1996 and 2006, Mr XU A-Shen made a great contribution, and he also helped me subsequently by supplying *Paeonia* materials.

During our expedition to the Caucasus in 1999, particular help was given by Dr Sikharulidze and Dr Eristavi from the National Institute of Botany, Georgian Academy of Sciences at Tbilisi. We also obtained much help from the directors and staff of the Institute of Botany, Azerbaijan Academy of Sciences at Baku (particularly Dr O. V. Ibadov); the National Institute of Botany, Georgian Academy of Sciences at Tbilisi; the Batumi Botanical Garden, Georgian Academy of Sciences; the Stavropol Botanical Garden, Russia; and the Botanical Garden of Krasnodar University, Russia.

On our expedition to the western Mediterranean in 2001, great assistance was received from Dr A. Fridlender of the University of Marseilles. Dr YUAN Yong-Ming at Neuchâtel University, Switzerland, led us to the Generoso population of *P. officinalis* in southern Switzerland.

Dr T. Koruklu of Ankara University was key to the work in Turkey during our expedition to the eastern Mediterranean in 2002. In Greece, Prof. D. Tzanoudakis of the University of Patras kindly guided us to several important localities.

In Japan, Dr M. Nakata, now at the Toyama Botanic Garden, assisted in our trips to Shikoku in 1990 and 1992, and Dr CHEN Zhi-Duan of our laboratory joined our trip to Hokkaido in 1998.

Dr ZHU Xiang-Yun of our institute joined the expeditions to Sichuan, Shaanxi and Hebei provinces in 1985, and he again made an expedition to Sichuan and Chongqing (Mt Jinfoshan) with Mr SONG Shu-Yin in 1986. Dr QIU Jun-Zhuan, my former student, now in the USA, after whom *Paeonia qiui* Y. L. Pei & D. Y. Hong was named, made field trips to W Hubei, Henan and

NW Sichuan in 1988 and 1989, and Dr PEI Yan-Long, now in Canada, made trips to Shanxi and W Hubei in 1991, 1992 and 1993.

In our expedition to Henan in 1994, the late Prof. WANG Shui-Yi and Dr WANG Yin-Zhen formerly from Henan Agricultural University (now in our laboratory) were members of the team. Dr HE Yong-Hua from the Chengdu Institute of Biology, assisted our expedition to NW Sichuan in 1995 and Dr ZHANG Shu-Ren in our laboratory joined our expedition to Tibet in 1996.

Prof. YE Yong-Zhong from Henan Agricultural University, Dr FENG Yu-Xin (my former Ph.D student now in the USA) and I made a field trip to W Hubei, W Henan and Shaanxi in 1997, which was assisted by Mr DAI Zhen-Neng at the Bureau of Forestry of Baokang County, Hubei. At the same time, PAN Kai-Yu and Dr XIE Zhong-Wen, now in the USA, made a field trip to Anhui Province. In 1998, Mr LOU Lu-Huan helped us in our trip to Mt Tianmu in Zhejiang, and Dr CAO Wei assisted us in our expedition to NE China.

I did field work in Idaho in 1999 with the assistance of Dr Jenny Q. Y. Xian (now at North Carolina State University). In 2005, PAN Kai-Yu and I made a field trip to western N America. Assisted by Dr QIU Jun-Zhuan, we observed and sampled two populations of *P. californica* near Los Angeles. Miss P. Woodward organised a trip to the Blue Mountains in Oregon and Washington states, where we observed and sampled three populations of *P. brownii*.

We made several field trips in 2004. Prof. REN Yi, from Shaanxi Normal University, assisted our expedition to Mt Taibaishan in Shaanxi. Dr ZHOU Zhi-Qin, of Southwest University, and Mr YANG Shi-Xuan joined our trip to Mt Shennongjia in W Hubei. Mr CAO Rui, at Inner Mongolia University, and Dr YANG Fu-Shen and Miss PENG Dan, of our laboratory, assisted our expeditions to Inner Mongolia. Mr ZHANG Hong-Yue and Mr CHEN Yan, of our laboratory, joined our several expeditions to NE China, Hebei, Henan and Inner Mongolia.

Miss LI Er-Li made the pencil and ink drawings, whereas Miss CAI Shu-Qin and Mr SUN Yin-Bao drew the ink drawings for this monograph. All the scanning electron microscope photographs were taken by Mr XIAO Yin-Huo and developed by Mr YANG Xue-Jian. Miss LI Qiao-Ling, my former secretary, helped a great deal with office work and in the preparation of articles and applications for grants.

To all the persons mentioned above, we are greatly indebted. In addition, our work was helped incalculably by many local farmers and villagers in China and elsewhere. We cannot mention them individually but we offer them all our sincere thanks. Without them, our work would not have been successful.

1. INTRODUCTION

1.1 COURSE OF WORK CONTRIBUTING TO THIS MONOGRAPH

1.1.1 BEGINNINGS IN CHINA

Although my work on *Paeonia* began in 1985, at first I was also engaged in other projects. I started to make expeditions especially for *Paeonia* in 1993, when I conducted field observations in the Tianshan and Altai mountains with Prof. PAN Kai-Yu (my wife) and Dr (then Mr) T. Sang, and in Shanxi Province with my Ph.D student, PEI Yan-Long. In 1994, we made a field trip to Henan and Shaanxi provinces.

In 1994, my wife and I also stayed for three months at the Missouri Botanical Garden, working on the *Flora of China* Project. This stay turned out to have great importance for our studies of *Paeonia*. Dr P. Raven, the late Dr W. Dai and Dr I. Al-Shehbaz all encouraged me to apply to the National Geographic Society for a grant for field work on *Paeonia*, which subsequently funded four expeditions.

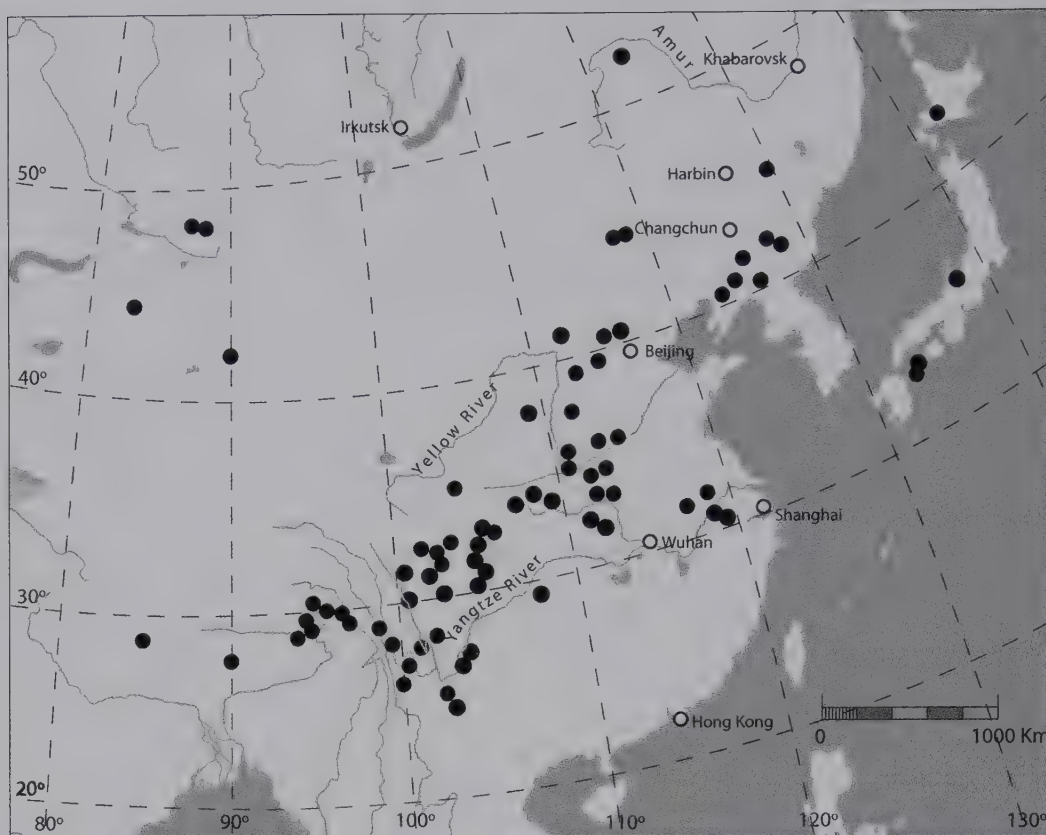
With the assistance of Mr (now Dr) LUO Yi-Bo and Mr HE Yong-Hua, I made an expedition to NW Sichuan Province in the autumn of 1995, making a field survey of *P. decomposita* and the *P. delavayi*-*P. potaninii* group.

In the spring of 1996, Mr LUO Yi-Bo and Mr (now Dr) ZHANG Su-Ren joined my field trip to Xizang (Tibet), where I was excited by finding the tree peony then named *P. lutea* var. *ludlowii* Stern & G. Taylor, which grows up to 3.5 m tall. I found that this plant differs distinctly from the *P. delavayi*-*P. lutea* complex in a number of characters, and so I raised it to specific rank, *P. ludlowii* (Hong, 1997a).

In early 1997, with the assistance of Prof. YE Yong-Zhong and Miss (now Dr) FENG Yu-Xin, I made a field trip to Henan, Shaanxi and W Hubei provinces. In W Hubei, we examined the type specimen of *P. ridleyi* Z. L. Dai & T. Hong, and found it to be a superfluous name of *P. qiui* Y. L. Pei & D. Y. Hong. We also found the individual plant from which the type specimen of *P. baokangensis* was collected. This peony, cultivated beside a farmer's house in Huoping Township, Baokang County, turned out to be a hybrid between *P. rockii* subsp. *rockii* and *P. qiui*.

An even more exciting trip was made to NW Yunnan and SW Sichuan provinces in the spring of 1997. Starting from the western hills of Kunming, a group including PAN, Prof. GU Hong-Ya from Peking University and Dr YU Hong from Yunnan University moved NW and up to Dêqên County near Xizang (Tibet). During our extensive travels, we found great variation in petal colour in the *P. delavayi*-*P. lutea* complex, which included four species and three varieties according to Stern (1946). The petal colour ranged from greenish-yellow to dark purple through solid yellow or white, yellow with various red spots at the base, orange, orange-red, pink and purple. Our most exciting discovery was in Zhongdian County (now Xianggelila), where we found two populations each containing even more variations in petal colour than mentioned above (Fig. 3.13), a typical polymorphism! As a result of this expedition and our 1995 travels in NW Sichuan, we published "Taxonomy of the *Paeonia delavayi* complex (Paeoniaceae)." (Hong *et al.*, 1998a), which recognised *P. delavayi* as the only species in this complex and reduced all other names to synonyms.

Combining knowledge gained on these four expeditions with what we had learned from previous field trips, PAN and I next revised the taxonomy of the *Paeonia suffruticosa* complex (Hong



Map 1.1. The sites in Asia visited.

& Pan, 1999a), and soon afterward published a synopsis of the taxonomy of tree peonies (Hong & Pan, 1999b), including eight species in the group (sect. *Moutan* DC. or subg. *Moutan* (DC.) Ser.).

Encouraged by the success of our work on tree peonies, we applied to the National Geographic Society for a second grant to work on the herbaceous *Paeonia obovata* complex of E Asia. In 1998, I made a field trip to Mt Tianmu in W Zhejiang province with PAN, and to Henan, Shanxi, Liaoning and Jilin provinces with PAN and my former Ph.D student, Dr RAO Guang-Yuan from Peking University. Field observations had already been made in Japan (Shikoku and Hokkaido) in 1990, 1992 and 1998, and in Sichuan, Chongqing, Hubei, Anhui and Shaanxi in 1985 and 1986. Combining all this information, we found that the widely recognised taxon *P. japonica* was based on a mere variation in petal colour. We also found that populations in mountainous areas of W Hubei, W Henan, NW Sichuan, Shaanxi and Shanxi provinces and in N Chongqing, which are tetraploid with leaves usually densely villose beneath, have differentiated from those in the other areas to the subspecific stage. We published the result as "Cytogeography and taxonomy of the *Paeonia obovata* polyploid complex." (Hong *et al.*, 2001c).

1.1.2 TOWARDS THE CAUCASUS, EUROPE AND THE MEDITERRANEAN

My road to this *Paeonia* monograph led first from E Asia to the Caucasus, then to Europe and the Mediterranean. Supported by a third grant from the National Geographic Society and with the assistance of my former Ph.D student, Dr ZHOU Shi-Lian, I made an expedition to the Caucasus in the spring of 1999. Dr Raven kindly warned me before I left Beijing, "Avoid Abchasia and

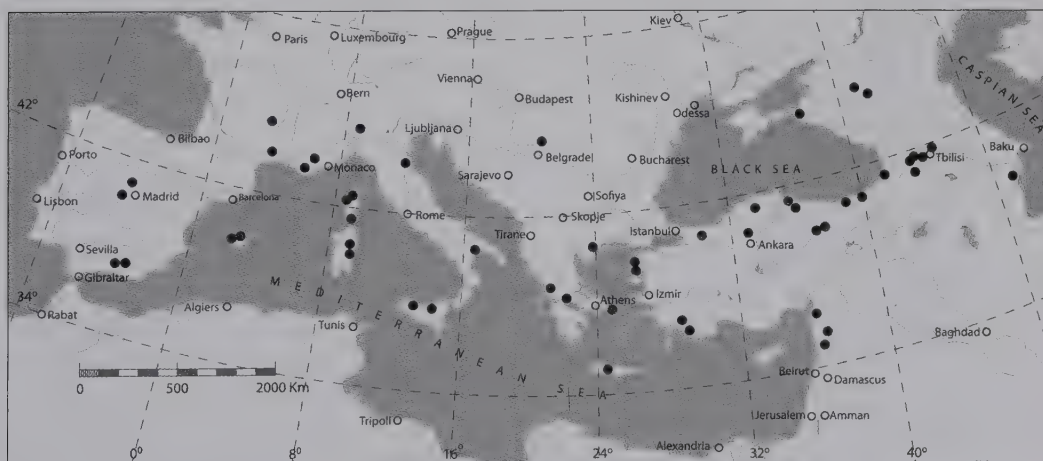
Chechnya!”. Indeed, the trip was very difficult with several shocks but it was also very exciting and successful. With great help from Drs Sikharuildze and Eristavi of the Tbilisi Botanical Institute, we based ourselves in Tbilisi and travelled to many parts of Georgia, including Ajaria, to Stavropol, Pyatigorsk and Krasnodar in Russia, and to Lerik in Azerbaijan (near Iran).

In the *P. tenuifolia* group, we found great variations within populations in colour of sepals, filaments and indumentum on carpels (Fig. 3.11), and in the width of leaf segments. We also saw that two types of leaf segments can occur on the same plant. Both in natural populations in Georgia and at the Tbilisi Botanic Garden, fertile shoots had leaf segments of normal width, whereas vegetative shoots had wider segments. These two variations, in colour and width of leaf segments, cover the characters of three ‘species’, *P. tenuifolia*, *P. biebersteiniana* and *P. carthalinica*.

Even more striking were our observations on the *P. wittmanniana*–*P. mlokosewitschii* group. The taxonomic treatment of this group in the Caucasus had been controversial. According to Schipczinsky (1937), there were seven species there; Kemularia-Nathadze (1961) even recognised nine. She distinguished those species using characters such as colour of petals, and size, shape and colour of leaflets or leaf segments. We found petal-colour polymorphism in Lagodekhi, Georgia (Fig. 3.13b) very similar to that in *P. delavayi* in Yunnan. Our statistics based on population samples showed that size and shape of leaflets or leaf segments are not reliable characters for distinguishing species. Guided instead by geographical differentiation of morphological characters and variation of chromosomes in ploidy, we recognised only one species, *P. daurica*, with five subspecies, which we published as “*Paemonia* (Paeniaceae) in the Caucasus” (Hong & Zhou, 2003).

Our confidence with regard to working on *Paemonia* in all parts of the world and to preparing a monograph increased with the success of our three grants, so we applied for a fourth National Geographic Society grant. We planned to go to Algeria and the islands of the western Mediterranean. For security reasons, we had to cancel the Algerian trip. But with the assistance of Dr WANG Xiao-Quan, my former Ph.D student, and Dr A. Fridlender from the University of Marseilles, we visited S and SE France, Corsica, Sardinia, Sicily, Italy, the Balearic Islands and Switzerland. In all, we observed and sampled 14 populations.

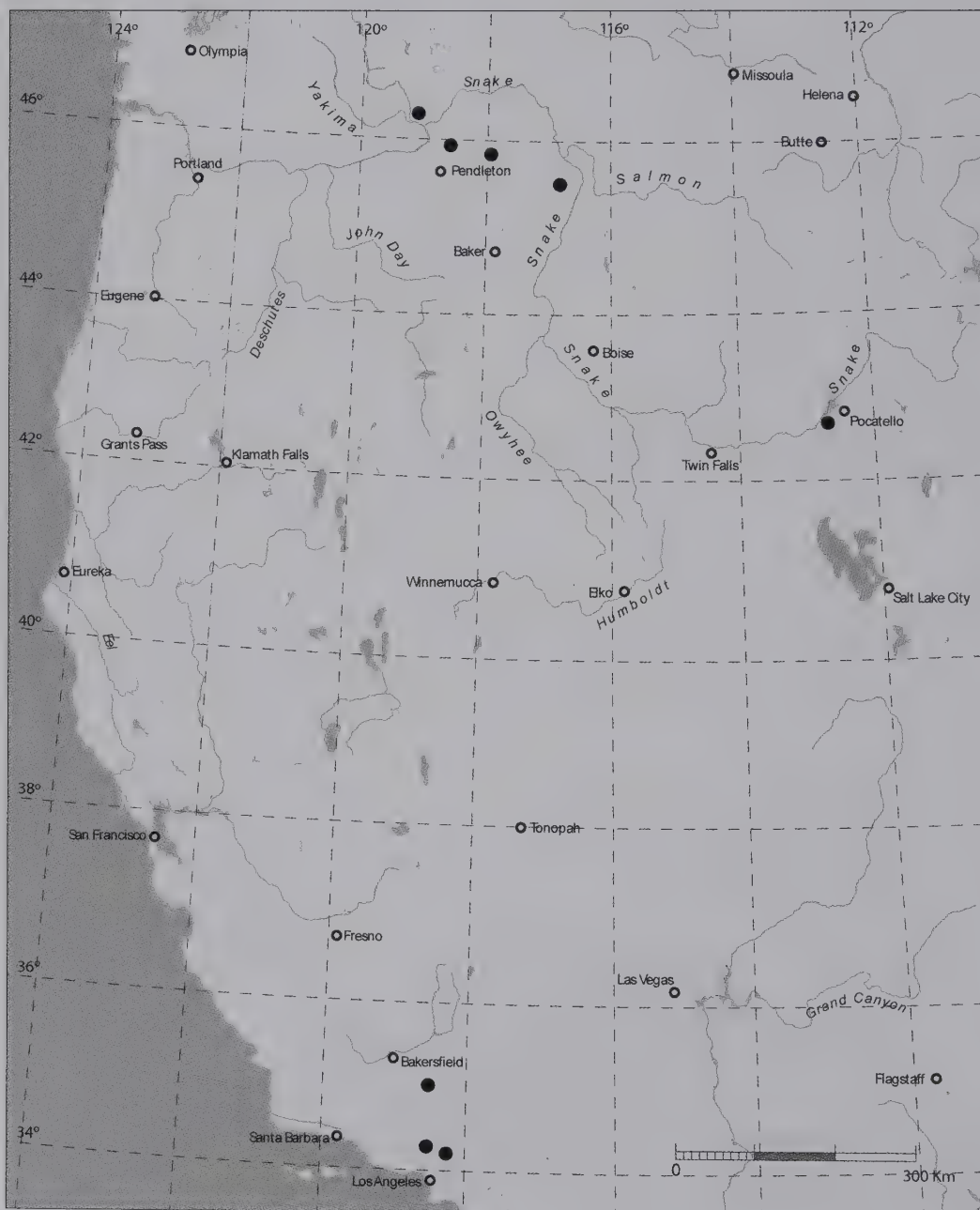
Our first impression of *Paemonia* in Europe was that the *P. mascula* complex and the *P. officinalis* complex were overcomplicated, and that the taxonomy of these two groups needed revision. Because the history of taxonomy in this region is the longest in the world, with a huge literature and numerous synonyms, we knew it would not be easy to sort out all confusions. We did realise that the Mediterranean region is an integrated floristic unit, and thus a number of questions could not be



Map 1.2. The sites in Europe and W Asia visited.

answered without knowledge of the peonies of Greece and Turkey. Therefore, we applied to the National Geographic Society for a fifth grant. Fearing that the reviewers and the society would be tired of us, I added: "This is my last application."

Accompanied by Drs ZHANG Da-Ming and WANG Xiao-Quan, two former Ph.D students of mine, and with the help of Dr S. T. Koruklu from Ankara University, we travelled in N, W and S Turkey, where we observed and sampled 17 populations, covering *P. peregrina*, *P. mascula* subsp. *mascula* and subsp. *bodurii*, *P. daurica*, *P. kesrouanensis*, '*P. turcica*' and *P. arietina* (= *P. mascula* subsp. *arietina*).



Map 1.3. The sites in west N America visited.

Our most impressive findings were that all the populations of *P. arietina* (= *P. mascula* subsp. *arietina*) we visited had tuberous roots; and all the individuals we observed had stems, petioles and sepals that were densely hairy, in contrast to the other members of *P. mascula*. We wondered how these two distinct entities could be merged into a single species as in *Fl. Europ.* (Cullen & Heywood, 1964a, 1964b; Akeroyd, 1993; see more in Chapter 5). In addition, when we observed the variation in the lengths of styles and stigmas and in their curving position within and between populations of *P. turcica* and compared these to data from *P. kesrouanensis*, we could not understand how *P. turcica* was described as a new species based solely on “the difference” of the total length of styles and stigmas (Fig. 3.15).

In Greece, with help from Prof. D. Tzanoudakis at the University of Patras, we made four trips, to Mt Parnassos, to Mt Ochi on Euboea Island, to Akarnania in W Greece, and to Kavala. In Kavala, we searched for the peony collected by Dr Sauer and his wife, found it and sampled a population. After extensive morphological comparison with its allies and after statistical analysis, this peony was found to be a genuine species, which we described as new (Hong *et al.*, 2004a).

For supplementary information, I made expeditions in 2003 to Spain and Serbia. Visits to the Sierra Nevada, Sierra de Avila and Sierra de Gredos were important for understanding the biology of the four species in the Iberian Peninsula and their relationships. A visit to the Banat area of Serbia helped me to learn whether the peony there (and also in the Mescled mountains of S Hungary) is *P. banatica* Rochel or *P. officinalis* subsp. *banatica* (Rochel) Soó.

In contrast to the situation in Asia, in Europe much taxonomic literature and a large quantity of herbarium specimens are preserved in a number of large herbaria. For a better understanding of *Paeonia* in Europe and the Mediterranean, one must make full use of these resources. This can be challenging. Much of the literature is very old, rare, and difficult to obtain. Most old specimens have labels with only a few words on them, often in almost illegible handwriting. I have spent much time in many libraries in Europe and the USA searching for literature, with much help from librarians and colleagues. I have visited nearly all the large herbaria in Europe, and I visited the herbaria BM, K, LE, MA and WU twice.

Thanks to the combination of field work, examination of a large number of herbarium specimens, and studies of old literature, I found (to my surprise) that *P. corsica* Sieber ex Tausch (1828), neglected by most authors, is a valid name for a genuine species in Corsica, Sardinia, the Ionian islands and Akarnania Province of Greece; it is distinct from *P. mascula* (including subsp. *russoi*). I also found, with assistance from Prof. Castroviejo from MA, that *P. broteri* Boiss. & Reut. (1842), a name commonly used in recent literature, is a superfluous name of *P. lusitanica* Mill. (1768), although we proposed the conservation of the better known name *P. broteri* in 2007.

Our intensive work on the peonies in Europe and the Mediterranean has brought a substantial change in the taxonomy of this region. Readers can easily find the differences between our taxonomy from those in *Fl. Europ.* (both editions 1 (1964) and 2 (1993)) and those described by Schmitt (1997), Stearn & Davis (1984), Kemularia-Nathadze (1961) and Halda (2004).

1.1.3 TOWARDS NORTH AMERICA

The peonies in N America form a distinct group, sect. *Onaepia*, one of the three sections of the genus *Paeonia*. Of the three sections, *Onaepia* has the fewest problems in taxonomy, but whether it comprises one species (*P. brownii*) or two species (*P. brownii* and *P. californica*) — i.e. whether *P. californica* is an independent species or a subspecies of *P. brownii* — is still in dispute (Halda, 2004), although most authors recognise both species.

While in the USA for the XVI International Botanic Congress in August of 1999, I visited Idaho State University at the invitation of Dr J. Q. Y. Xiang and was able to observe a population of *P. brownii* near Pocatello.

At the invitation of Dr M. Dillon and Dr J. Wen of the Field Museum of Natural History in Chicago, PAN and I visited the USA in 2005. Before going to Chicago, we conducted expeditions in S California and the Blue Mountains in late May. In S California, with assistance from Dr J. Z. Qiu, we visited the Long Pine Canyon in San Bernardino County, where we sampled a population of *P. californica* Nutt. ex Torr. & A. Gray. These plants were frequently seen in the chaparral vegetation in soil that was soft and very dry. The roots were all fusiform, up to 3 cm in diameter and 50 cm long. Such roots may well function as an organ for storage of water and nutrients. Our two other major findings were that all the lower leaves examined (see 'Chapter 3. Characters and their variations') were ternate, a unique character state in *Paesia*, and that the number of carpels was mostly three or two, very rarely four. We sampled another population of this species in Los Angeles County. The characters of this population were basically the same as those in San Bernardino County.

Miss P. Woodward from Canada kindly organised a trip for us to the Blue Mountains in Oregon and Washington states. She and her local friends guided us to exact sites for the peony *P. brownii*. We observed and sampled three populations that were still in bloom. Although these plants also had fusiform roots, all the lower leaves examined were biternate with many more leaf segments or lobes, and they mostly had five carpels. There are additional differences between *P. brownii* and *P. californica*, and I have been wondering, since this field work, how these two distinct species could be seen as conspecific by some authors (e.g. Halda, 2004).

1.2 METHODOLOGY

1.2.1 FIELD OBSERVATIONS

Many character states of *Paesia* cannot be seen in herbaria. Stebbins (1939: 245) realised this problem and stated, "the most important specific distinctions in floral characters are difficult or impossible to recognise in herbarium specimens." In herbaria we see only individuals, not populations; we see only part of the entire range of character variation, particularly in *Paesia*. Therefore, field work is essential for understanding the biology of *Paesia*, and thus for a rational taxonomic revision.

With this in mind, I made expeditions to nearly all parts of the distribution range of *Paesia* (Maps 1.1, 1.2 and 1.3). The only species whose localities have not been visited for this study is *P. algeriensis* because of the security problems mentioned before. In addition, one locality of *P. emodi* in Xizang (Tibet) (probably the only locality in China) was visited by my assistant, Dr ZHOU Shi-Lian, but not by myself.

Without field work, I would not have discovered how important root shape is for the taxonomy of *Paesia*, and we would not have been able to observe petal-colour polymorphism (Fig. 3.13). Further, I would have been unable to evaluate the pattern of lower leaves and their variation within and between populations (Figs 3.4 and 3.5). Without field work, we would not have sampled so many populations for statistical analysis and detailed investigation. In the field, we documented various character states and their variations with camera and pencil; we documented population ecology, collected frequently associated plants, and of course, conducted population sampling.

1.2.2 POPULATION SAMPLING

Because many *Paesia* species are rare or even endangered, and most species have small populations, our sampling was based on the least possible damage to wild populations. We usually dug out two or three whole individuals for three purposes: to observe the underground part, to have one plant as a specimen and one or two plants for transplantation into the Beijing Botanic Garden, Institute of Botany (CAS). We collected the aerial parts of three or four additional individuals as specimens,

leaving the underground parts intact. Therefore, we usually took five or six specimens from each population, which were distributed to herbaria: A, BM, CAS, K, MO, PE, UPA and/or US. In addition, we harvested one lower leaf of four or five more individuals. We also made notes of character states and their variations in other preserved individuals. Thus, the size of our population samples is $n \geq 10$. Population samples were always randomly selected.

1.2.3 USE OF ALL AVAILABLE HERBARIUM SPECIMENS

I have tried to visit as many herbaria and to examine as many specimens as possible. The list of herbaria visited, the list of herbarium specimens examined and the citation of specimens examined under each species are extensive. We examined nearly all herbarium specimens available, often looking at a large number of specimens from a single locality or region, many of which were used for statistical analysis. For some collections, we examined quite a large number of duplicates in different herbaria. For example, we examined 10 duplicates of the collection *E. Reverchon* 291 (from Mt Limbaro, N Sardinia, Italy) in the herbaria E, K, P and WU. Among these specimens, six individuals had tomentose carpels, one had very sparsely hairy carpels, and the other three had entirely glabrous carpels. Such collections can function to some extent as a population sample and provided us with an opportunity to see peonies as in nature. In the herbaria, I documented characters in detail, paying special attention to diagnostic characters, so that the specimens in different herbaria could be compared and the data used for statistical analysis.

1.2.4 LITERATURE STUDIES

I searched hard for relevant taxonomic literature on *Paeonia*, particularly the very old literature, and I was able to obtain nearly everything that came to my attention. I read each document carefully, and raised questions, if any, afterwards. When I had field experience, I read the literature critically once again. Recent literature should be referred to, but should not be entirely relied on. When I read Miller's (1768) dictionary for the first time, I had the impression that his description of *Paeonia lusitanica* is rather clear; then a question arose: why does Stern's (1946) monograph consider it an ambiguous name? After my expeditions in Europe, with knowledge of the roots of all the species in the region, I realised that Miller's description clearly referred to the peony known by the later name *P. broteri* Boiss. & Reut. (1842) (Cullen & Heywood, 1964b; Akeroyd, 1993; Muñoz-Garmendia & Navarro, 1993), and that it is clearly distinguished from *P. officinalis* subsp. *microcarpa* (= *P. humilis*), particularly in the character of root shape. Portugal has two species of *Paeonia*, and the common one has carrot-shaped roots, without tubers or knobs, as Miller described. Thus, *P. lusitanica* Mill. is a valid name for the peony in Portugal and Spain, whereas *P. broteri* is recognised as a superfluous name of *P. lusitanica* Mill.

Another example regards the identity of *Paeonia suffruticosa*, the first tree peony species described. This species had long been confused with other tree peonies until Hong and PAN (1999a, 1999b) obtained the original material of Andrews (1804) and found that none of the specimens later cited by Stern (1946) under *P. suffruticosa* belong to this species. Instead these belonged to *P. rockii*, a different tree peony. Haw (2001a) further considered *P. suffruticosa* as the cultivated tree peony of hybrid origin.

1.2.5 STATISTICAL ANALYSIS

Taxonomy is often referred to as imprecise, a "meeting ground of Science and Art". I completely disagree with this. Taxonomy is a discipline of science, a rigorous and hypothesis-tested branch of biology. The most important part of this work is the analysis of characters, which is crucial for understanding characters and their variation. Genetics, cytology, ecology and even developmental biology should be involved in this analysis. In addition, mathematics must be introduced to evaluate quantitatively the range and pattern of character variation and to treat large datasets. It has been said

that no branch of science can be precise unless mathematics is introduced. Today's taxonomy is still not very precise. Taxonomists do not yet fully use knowledge from the other branches of biology to understand characters completely, and many still do not evaluate characters using statistics.

In the early stages of the present work, we used two methods of statistical analysis: standard deviation and the scatter diagram. Standard deviation was used to detect whether the variation ranges of a character are continuous or discontinuous between two groups under study. Scatter diagrams were used to illustrate whether two groups under study are distinct, not distinct or intermingled.

Recently, we have also used multivariate analysis: cluster analysis and principal-coordinate analysis. The advantages of these two methods are: (a) they share a set of data; (b) characters can be several or numerous; and (c) they are obtained by computer analysis. Data from population samples and herbarium specimens were combined in our statistics.

The selection of characters for statistical analysis demands insight into taxonomic questions. It must be based on field and herbarium work. The characters used must be of two kinds: the ones used by previous authors, and those newly found to have some diagnostic value. We think that the introduction of statistics can at least reduce artificial elements in the evaluation of characters and taxonomic judgment.

1.3 PRINCIPLES OF TAXONOMIC TREATMENT

1.3.1 SPECIES

The most important and difficult taxonomic treatment is the delimitation of species. What defines a species is one of the most controversial questions in biology. Among the 22 species concepts (Maydon, 1997), the morphological species concept and the biological species concept are the most widely discussed or used. The biological species concept is theoretically rational, and important, particularly in zoology. Even in theory, however, it cannot be used widely for plants, as too many morphologically distinct plant species (or even those species isolated for millions of years, e.g. *Liriodendron chinensis* in E Asia and *L. tulipifera* in southeastern N America) are still interfertile. Furthermore, the biological species concept entirely collapses for apomictic plants, which are not rare in the plant kingdom. Its usage is even more difficult in practice because we are rarely able to make a cross before making a taxonomic decision.

For all these reasons, we used a species concept based mainly on morphology in our study of *Paeonia*. In our sense, a plant species is generally an assemblage of populations or all available specimens that is distinct (or statistically distinct) from any other in two or more morphological characters but shows continuous variations between elements within the assemblage, and represents an independent lineage. By distinct differences, we mean that the assemblages under study have two or more morphological characters that show distinctly different (for qualitative characters), discontinuous or statistically discontinuous (for quantitative characters) variations between them, and are thus readily distinguished. These two or more characters are usually correlated with each other. This species concept has a biological meaning: a species so circumscribed has genetically differentiated from all others, generally evolving independently for a long time, that is, it has not hybridised recently with any other in nature.

Taking the tree peony, *Paeonia* sect. *Moutan* DC., as an example, we can explain how we delimit species in our work. We substantially revised the taxonomy of this section (Hong & Pan, 1999b). As a result of extensive field observations, we found that *Paeonia lutea* var. *ludlowii* Stern & G. Taylor differs from other members of the *P. delavayi* complex (*P. delavayi*, *P. lutea* and *P. potaninii*) in having single carpels (only 3% of flowers with two carpels) rather than two to four, in having larger follicles (4.5–7 cm long rather than c. 4 cm long) and in other aspects. We therefore raised this entity from

variety to species, *P. ludlowii* (Hong, 1997a). Haw (2001a: 161–162) states, “D. Y. Hong makes a convincing case for raising *P. ludlowii* to the rank of species”. Elsewhere in the complex, however, we reduced *P. lutea* Delavay ex Franch., *P. potaninii* Kom. and *P. potaninii* var. *trillioides* (Stapf ex Stern) Stern, which were recognised by Stern in his monograph (Stern, 1946), to synonyms of *P. delavayi* Franch. because a yellow petal is just one of various forms in the petal-colour polymorphism. Also, the leaflets on lower leaves can vary continuously from 17 to 312 in number and from 0.5 to 4.5 cm in width (Hong *et al.*, 1998a). In conclusion, we recognise eight species in sect. *Moutan*. This taxonomic synopsis is supported by random amplification of polymorphic DNA (RAPD) analysis (Zou *et al.*, 1999), cladistic analysis based on morphological data (Zhou *et al.*, 2003) and by glycerol-3-phosphate acyltransferase (GPAT) gene sequences (Zhao *et al.*, 2004). Among the eight species, the closest relationship based on morphological evidence seems to lie between *P. qiui* and *P. jishanensis*. *Paeonia qiui* differs from *P. jishanensis* in having the leaflets mostly entire (rather than all lobed), the sepals consistently caudate (rather than rounded) at the apex, and the petals usually with a pinkish spot at the corolla base rather than pure white, rarely pinkish at the corolla periphery (cf. Figs. 5.7A, 5.7B to Figs. 5.6A, 5.6B). As a result of a recent taxonomic revision of *P. suffruticosa* subsp. *yinpingmudan*, with new information from morphology and DNA sequences, we describe *P. cathayana* as new, treating the peony from Anhui as a synonym of *P. ostii* (Hong & Pan, 2007). Therefore, the eight wild species in sect. *Moutan* are distinct in morphology, each forming a monophyletic entity (Zou *et al.*, 1999; Zhao *et al.*, 2004).

The species recognised in our present work do not necessarily correspond to biological species, though they are distinct in morphology and each may well represent an independent lineage. According to our field observations, these eight species do not coexist, though some are apparently sympatric, and significantly, no hybrids between these species have been found in natural conditions. This differs, however, when these species are introduced into cultivation. For example, *P. rockii* and *P. qiui* are two distinct species, two good species in our sense, but a large number of hybrids between them were found in 1997 in two villages of Huoping Township, Baokang County, W Hubei. Here, the two species had been introduced from the nearby mountains and grown together in farmers' yards. Nevertheless, the two species were found as distinct populations during our field work and on different mountains. This implies that no reproductive barrier effectively exists between the two species. This might be expected since all the species investigated in *Paeonia* sect. *Moutan* subsect. *Vaginatae* Stern are of similar karyotypes (Hong *et al.*, 1988, unpubl.). Saunders and Stebbins (1938) did, however, find evidence of reproductive isolation between species in *Paeonia* subsect. *Delavayanae* Stern and subsect. *Vaginatae*. After making extensive crosses between *P. suffruticosa* and *P. delavayi* they observed hardly any hybrids, with the few obtained being sterile.

The 24 herbaceous species (in *Paeonia* sect. *Paeonia* and sect. *Onaepia*) circumscribed here, according to our principles, are also independent entities in nature. During extensive field observations, we rarely found hybrids between them in nature. Nevertheless, many species are sympatric, for example: *P. obovata* and *P. lactiflora* in N Hebei Province, China; *P. mairei* and *P. anomala* subsp. *veitchii* in the Qinling Range, China; *P. coriacea* and *P. broteri* in the Sierra Nevada, Spain; and *P. broteri* and *P. officinalis* subsp. *microcarpa* in the Sierra de Gredos, Spain. There are three species in Hatay Province of S Turkey: *P. daurica*, *P. mascula* and *P. kesrouanensis*. *Paeonia kesrouanensis* (tetraploid) and *P. daurica* (diploid) were found growing side by side in the same *Fagus orientalis* and *Pinus sylvestris* forest on Mt Amanus, but no hybrids were discovered there. We did not find hybrids between *P. daurica* and *P. mascula* (tetraploid), neither between *P. mascula* and *P. kesrouanensis*. Therefore, not only are our species distinct in morphology but also at least some are reproductively isolated. The only recorded natural hybrid is *P. × saundersii* G. L. Stebbins between *P. triternata* (= *P. daurica*) and *P. tenuifolia* (Stebbins, 1939; see ‘Hybrids’ in this monograph).

In summary, the species recognised herein in *Paeonia* are distinct or statistically discontinuous from each other in two or more morphological characters, and each represents an independent

lineage. The taxa are geographically allopatric or sympatric but usually ecologically differentiated. Hybrid taxa were scarcely found in nature, though some species pairings appear to lack reproductive barriers.

1.3.2 SUBSPECIES

Subspecies in our sense are entities that are both geographically (horizontally or vertically) and morphologically differentiated, but not distinctly different from each other in morphology. As opposed to species, subspecies may contain some individuals that are similar to individuals within other subspecies. Thus, the identification of a subspecies sometimes requires knowledge of the origin of materials. Subspecies of a species (unlike species of a genus) do not overlap in distribution range, that is to say, they are distinct horizontally or vertically. In *Paeonia*, eight species each comprise from two to seven subspecies, that fit our criteria of subspecies very well. We treated *P. veitchii* Lynch (1909) as a subspecies in *P. anomala* L.; thus *P. anomala* comprises two subspecies, subsp. *anomala* and subsp. *veitchii* (Lynch) D. Y. Hong & K. Y. Pan (Hong *et al.*, 2001a; Hong & Pan, 2004). *Paeonia veitchii* was described as a new species because it has several flowers to a stem, whereas *P. anomala* has only one flower to a stem; it is distributed in central China (Lynch, 1909; Stern, 1946; Pan, 1979). *Paeonia altaica* was described by Dai and Ying (1990) as a new species from the Altai, Xinjiang, because individuals have two flowers on a stem. Our close examination of a large quantity of specimens found that within the distribution range of *P. anomala* in the strict sense, the majority of individuals had only one flower to a stem, but some individuals had one or two sterile flower buds in addition to one normal flower to a stem, and a very few individuals had two normal flowers on a stem. The '*P. altaica*' form represents this extreme in *P. anomala*. By contrast, within the distribution range of subsp. *veitchii*, a great majority of individuals possessed two to four flowers to a stem, but some possessed only one normal flower in addition to one or two undeveloped flower buds on a stem, and there were even a few individuals with only one flower without any sterile flower bud (so-called '*P. veitchii* var. *uniflora*'). Therefore, subsp. *anomala* and subsp. *veitchii* are different in distribution but not distinct in morphology. Actually, they overlap in morphology to some extent and are isolated geographically by the Gobi. The two entities fit well into subspecific status.

1.3.3 VARIETY AND FORM

Variety and form are not recognised in our taxonomic treatment of *Paeonia*. The rank of variety is usually used for ecotypes, but in *Paeonia*, ecotype differentiation is not remarkable. The rank of form is often used to describe variations and different states of a single character such as colour of petals, leaves and stems, or the presence, absence, or density of indumentum. However, such variations (i.e. polymorphisms) are frequently found within populations in *Paeonia*, particularly in sect. *Paeonia*. If we use the rank of *forma* for polymorphic variations, we risk treating sister individuals as different taxa. Horticulturists may describe forms for their purposes, but horticulture is another discipline of science.

1.3.4 TREATMENT OF CULTIVATED PEONIES

At least seven species in *Paeonia*, i.e. *P. suffruticosa*, *P. ostii*, *P. jishanensis*, *P. rockii*, *P. lactiflora*, *P. officinalis* (in the broad sense) and *P. peregrina*, together with many hybrids, have long been cultivated in China, Japan and Europe. The number of tree peony cultivars may well be over 1,000. Since the present work deals mainly with wild peonies, the treatment of cultivars is out of our scope, the exception being those cultivars that have been described as species, e.g. *P. mollis* G. Anderson, *P. bakeri* Lynch, *P. barrii* Lynch, *P. suffruticosa* Andrews, *P. papaveracea* Andrews and *P. moutan* Sims.

2. HISTORY OF TAXONOMIC STUDIES ON PAEONIA

Readers may see Stearn and Davis (1984) for the history of taxonomic studies of *Paeonia* before Linnaeus (1753).

This chapter gives a brief review of the taxonomic history of *Paeonia* since Linnaeus (1753), followed by my commentary on that history.

2.1 BRIEF REVIEW OF THE TAXONOMIC HISTORY OF PAEONIA SINCE LINNAEUS (1753)

Linnaeus (1753) described one species, *Paeonia officinalis* L., with two varieties, *feminea* and *mascula*, both based on specimens from Switzerland (Helvetica). Six years later, Linnaeus further described two species, *P. officinalis* and a new species based on a specimen from Ukraine, *P. tenuifolia* (Linnaeus 1759). Working under the name Linné after 1761, he added an additional species, *P. anomala* from Siberia (Linné 1771), which is widely distributed in Asia and NE Europe.

Miller (1768), a horticulturist in the UK, described six new species in clear detail: *Paeonia mascula*, *P. feminea*, *P. peregrina*, *P. hirsuta*, *P. tartarica* and *P. lusitanica*, of which *P. tartarica* and *P. lusitanica* were considered “*no satis nota*” (ambiguous) by Stern (1946: 148). In our view, none of these names are now ambiguous. However, *P. lusitanica* has been rejected in order to conserve *P. broteri*; *P. feminea* and *P. hirsuta* are synonyms of *P. officinalis*; *P. tartarica* is a synonym of *P. peregrina*.

Pallas (1776) described a new species also from Siberia, *Paeonia lactiflora*, a herbaceous peony that is widely distributed in eastern Asia and widely cultivated in China and Japan for both ornamental and medicinal purposes. In his *Flora Rossica* Pallas (1788) described six species, *P. albiflora*, *P. officinalis*, *P. laciniata*, *P. hybrida*, *P. tenuifolia* and *P. sibirica*, among which *P. albiflora*, *P. laciniata*, *P. hybrida* and *P. sibirica* were new and are illustrated but with *P. laciniata* and *P. sibirica* sharing the same figure (tab. 85).

Retzius (1783) described four species in *Paeonia*, of which two are new, *P. corallina* and *P. humilis*. Based on his descriptions, the former is a superfluous name of *P. mascula* (L.) Mill. The other two are *P. officinalis* and *P. anomala*.

Donn (1804) raised the number of *Paeonia* species to eight with two new specific names, *P. daurica* and *P. arborea*. *Paeonia arborea* is the first name for the tree peonies, but unfortunately his two specific names are *nomina nuda*.

Desfontaines (1804) listed 10 species of *Paeonia* with two as new, *P. villosa* and *P. lobata*, but both are *nomina nuda*.

Andrews (1804) is the author who described the first tree peony, *Paeonia suffruticosa*, based on a cultivar introduced to Europe from Guangdong, China, in 1794. Three years later he described another new species, *P. papaveracea*, and one new variety, *P. suffruticosa* var. *purpurea*, and both were based on cultivated tree peonies from Guangdong (Andrews, 1807a). Andrews (1807b) added one more new species, *P. daurica*, based on a plant from Tauria, Crimea (the name *P. daurica* comes from an error in the spelling of Tauria).

Salisbury (1805) described *Paeonia edulis* as new based on a plant from Siberia (Baical), which was reduced by Donn (1815) to *P. albiflora* var. *edulis* (Salisb.) Donn.

Miller and Martyn's (1807) work should be mentioned. They described five additional species of *Paeonia*, *P. albiflora*, *P. officinalis*, *P. laciniata*, *P. hybrida* and *P. tenuifolia*. What is interesting is that they reduced all six species that Miller described as new in 1768 to six varieties under *P. officinalis*. Miller had died 16 years before the 1807 book appeared, so this work might not actually be his.

Sims (1808) described a further tree peony, *Paeonia moutan*, as new based on another cultivated plant from Guangdong. Saint-Hilaire (1809) described two new species, *P. hirsuta* J. St.-Hil. from Spain, differing from Miller's (1768) *P. hirsuta*, and *P. rosea* from central France. Bivona (1816) described one more new species from Sicily, *P. russoi*.

The first monograph of *Paeonia* was read by Anderson to the Linnaean Society of London in 1817 and published in 1818, several months after he died. Anderson's monograph (1818) recognised 13 species, including four new ones, *P. decora*, *P. arietina*, *P. paradoxa* and *P. mollis*. He divided *Paeonia* informally into two major species groups, Fruticosa and Herbaceae. The former contains only one species, *P. moutan*, whereas the latter included the remainder of known *Paeonia*. As a horticulturist, Anderson based his descriptions of the 13 species on plants cultivated in gardens, and he described 27 varieties (cultivars) under seven of these species.

De Candolle (1818) recognised 14 species in *Paeonia*, including one new species, *P. lobata* Desf. ex DC. He also restored recognition of *P. peregrina* and *P. tartarica*, described as new species by Miller in 1768 but reduced to varieties by Miller and Martyn (1807), to species. De Candolle is the first author to formally divide *Paeonia* into two sections, sect. *Moutan* and sect. *Paeon* (*Paeonia*) (de Candolle, 1824). In sect. *Moutan*, he recognised only *P. moutan*, whereas in sect. *Paeon*, he recognised 13 species, which were divided into two informal groups according to whether the leaf was glabrous or puberulous.

Lindley (1824) described a new species using the name *P. cretica* Sabine, but according to his description, "*Folia....subtula glauca pubescentia*" and "*calyx....subpilosus*", this must refer to a plant from Turkey, not from Crete. Thus, Sabine's *P. cretica* is treated as a synonym of *P. arietina* G. Anderson.

The peony on the Balearic Islands of Spain was first recorded by Cambessèdes (1827), who identified it as *P[aeonia] corallina* var. *fructibus glabris*. Nearly 50 years later, Willkomm (1875) described it formally as a variety, *P. corallina* var. *cambessedesii* Willk., and soon after raised it to specific rank, *P. cambessedesii* (Willk.) Willk. (Willkomm, 1880).

Redouté (1827) illustrated a new species named *Paeonia fragrans* (Sabine) Redouté based on a cultivated plant from China, apparently a French cultivar of *P. lactiflora*.

Rochel (1828) described *Paeonia banatica* as new based on a plant from the Banat area in the Balkans. According to our field observations and examination of specimens from this region, his description and the aerial part of his figure are correct, whereas his account of the underground portion was less so. The root of this plant is actually tuberous. Its taxonomic position, whether an independent species or a variety or subspecies of *P. officinalis*, has been in dispute.

Tausch (1828) described seven species, of which four are new: *Paeonia promiscua*, based on cultivated plants introduced from southern Europe; *P. festiva*, based on widely cultivated plants native to Europe; *P. corsica* from Corsica; and *P. cretica* from Crete. Apparently, the first two are synonyms of *P. officinalis*; the third had been neglected by most authors until Hong and Wang (2006), and the fourth is a homonym of Sabine's *P. cretica* (Sabine & Lindley, 1824). The other three species considered by Tausch are *P. officinalis*, *P. lusitanica* and *P. humilis*, with only *P. officinalis* being accepted in our current treatment of the genus.

The first *Paeonia* species from the New World was described by Douglas but later published by Hooker (1829), *P. brownii* Douglas ex Hook.

Meyer (1830) described *Paeonia intermedia* as new from the Altai. This species had been poorly understood and confused with *P. anomala* and *P. hybrida* (= *P. tenuifolia*) until Hong and Pan (2004).

Host (1831) described *Paeonia rosea* as new (non *Paeonia rosea* J. St.-Hil., 1809). This name

referred to plants in Tyrol (now Italy), Banat (in Serbia) and Croatia, so that *P. rosea* Host synonymises to *P. officinalis* in the broad sense.

Based on a cultivated peony, Reichenbach (1832) described a new species, *Paeonia porrigens*, which he later illustrated (Reichenbach, 1840). This name is apparently a synonym of *P. officinalis*, from his description and illustration. Reichenbach (1840) illustrated and considered eight species of *Paeonia*: *P. tenuifolia*, *P. lobata*, *P. pubens*, *P. banatica*, *P. promiscua*, *P. officinalis*, *P. porrigens* and *P. corallina*. According to his illustrations, they all have tuberous roots. However, *P. corallina* (= *P. mascula*) has carrot-shaped roots (Fig. 5.21A).

Salm-Dyck (1834) proposed a taxonomic synopsis in which the genus was divided into eight sections according to habit, number of flowers on a stem, leaflets partite or not, shape of leaf blades, and indumentum of leaves, in order: *Suffruticosae*, *Albiflorae*, *Corallinae*, *Macrocarpae*, *Microcarpae*, *Compactae*, *Lobatae* and *Laciniatae*. He described 12 species in total, of which four species and two varieties are new: *P. subternata*, *P. lanceolata*, *P. microcarpa*, *P. multifida*, *P. humilis* var. *gallica* and *P. tenuifolia* var. *laciniata*. None of his sections, new species or new varieties has been recognised by later authors.

Torrey and Gray (1838) described the second peony species of N America, *Paeonia californica* Nutt. ex Torr. & A. Gray. This has been recognised as a species by all later authors except for Lynch (1890), who treated it as *P. brownii* var. *californica*, Brewer and Watson (1876), Baker (1884), Jepson (1909) and Munz (1935), who treated it as a synonym of *P. brownii*, and Halda (2004), who recognised it as *P. brownii* subsp. *californica*.

Boissier (1838) described a new species, *Paeonia coriacea*, based on a plant from Spain. This species has been recognised by all later authors except for Malagarriga (1975) and Schmitt (1997), who treated it as *P. mascula* subsp. *coriacea*. Boissier and Reuter (1842) described *P. broteri* as a new *Paeonia* species from Spain. This name was considered by Hong and Castroviejo (2005) as a superfluous name for *P. lusitanica* Mill. (1768), but because of the wide use of the name *P. broteri*, they proposed to conserve it against *P. lusitanica* Mill. (Hong & Castroviejo, 2005 — *Taxon*, 54: 211–212). Ten years later, Boissier & Reuter (1852) described another new species, *P. microcarpa* Boiss. & Reut., also from Spain.

Lindley (1846) described as new the first Caucasian species of *Paeonia*, *P. wittmanniana* Hartwiss ex Lindl. This is the first *Paeonia* species recorded as having yellow flowers. Two years later, Steven (1848) used the same specific name to describe another peony also from the Caucasus, but from a different area (the Transcaucasus). This peony was given a new name by Kemularia-Nathadze (1961), *P. steveniana* Kem.-Nath. This taxon is considered conspecific with *P. macrophylla* (Albov) Lomakin (1897), which itself was submerged by Hong and Zhou (2003), and accepted herein, as *P. daurica* subsp. *macrophylla*.

Seringe (1849) published a taxonomic system for *Paeonia* in which he raised de Candolle's (1824) two sections to subgeneric rank: sect. *Moutan* DC. to subg. *Moutan* (DC.) Ser., with only one species, *P. moutan*, and sect. *Paeon* to subg. *Paeon* (*Paeonia*). Under subg. *Paeonia* he placed the 23 species he recognised into two informal groups according to whether the carpels are hairy or glabrous. The group with hairy carpels was further divided into two informal subgroups according to the indumentum of their leaves. He included *P. brownii* and *P. californica*, the two species in the New World, in subg. *Paeonia*, failing to recognise their distinctness from the species of the Old World. No new species, but a large number of cultivars were described by Seringe, 24 cultivars for *P. moutan* (synonymised to *P. suffruticosa*), 13 in *P. albiflora* (= *P. lactiflora*), 25 in *P. officinalis* (referred to *P. paradoxa*, *P. peregrina* sensu Seringe and *P. lobata*), three in *P. humilis* (= *P. officinalis* subsp. *microcarpa*) and four in *P. decora* (= *P. peregrina*).

The first species of *Paeonia* from the Far East (Amur) was described by Maximowicz (1859) as *P. obovata*, one of four Eurasian herbaceous species with glabrous carpels (the other three are *P. kesrouanensis*, *P. cambessedesii* and *P. coriacea*).

Ruprecht (1869) described a new peony from near Stavropol in Russia, north of the Caucasus, *Paeonia biebersteiniana*. The leaf segments of this species were stated to be wider than those of *P. tenuifolia*. Whether this taxon should be treated as a species or as a variety in *P. tenuifolia* or in *P. hybrida* was controversial until Hong and Zhou (2003) found in Georgia and near Stavropol that the range of variation in width of leaf segments covered *P. tenuifolia* and *P. biebersteiniana*, and that sterile shoots had wider leaf segments than fertile ones in the *P. tenuifolia* group. Thus, *Paeonia biebersteiniana* synonymises to *P. tenuifolia* in the current treatment.

Moore (1879) described a second new species from the Far East (Liaoning Province, China) as *P. oreogeton*, which was later properly treated as a synonym of *P. obovata* by Baker (1884) and by Huth (1891).

Brândz (1881) described a second new species from the Balkans (Romania), *P. romanica* Brândz. This name was reduced by Huth (1891) and by Gürke (1903) to a synonym of *P. decora* (= *P. peregrina* herein).

Baker (1884) published a comprehensive paper on peonies, in which he adopted Seringe's (1849) treatment of two subgenera, the woody subgenus *Moutan* with only one species, *Paeonia moutan*, and a herbaceous subgenus *Paeonia*. He divided subg. *Paeonia* into three numbered sections: sect. I follicles glabrous; sect. II follicles tomentose, erect-arcuate when mature; and sect. III follicles tomentose, spreading from the very base when mature. The division of sections is apparently artificial as glabrous and pubescent carpels have been found within several species (*P. anomala*, *P. emodi*, *P. daurica*, *P. corsica*, and *P. lactiflora*), and even within populations, e.g. D. Y. Hong *et al.* H01015 (*P. corsica*), H04041 (*P. lactiflora*), H95034 (*P. anomala* subsp. *veitchii*). Baker himself recognised the presence of both states in *P. anomala* and *P. wittmanniana* (= *P. daurica* subsp. *wittmanniana* herein). He reduced several specific names to synonyms: *P. oreogeton* Moore to *P. obovata*; *P. intermedia* to *P. anomala*; *P. laciniata* and *P. hybrida* to *P. tenuifolia*; *P. californica* to *P. brownii*; *P. mascula* to *P. corallina*; *P. tartarica* to *P. arietina*; and *P. lusitanica* to *P. broteri*. The reduction of *P. oreogeton* and *P. hybrida* is justifiable, but the others represent independent taxa. Baker considered *P. cambessedesii* from the Balearic Islands a doubtful species. Twenty-two species in total were recognised in the paper, with no new taxa described.

Franchet is the author who first recorded tree peonies (Franchet, 1886) from their native habitats in China, describing two new species of tree peonies from Yunnan, *Paeonia delavayi* and *P. lutea*. The latter would be the first tree peony recorded with yellow flowers, and its taxonomy had been controversial — sometimes treated as a species (Huth, 1891; Stern, 1946; Halda, 2004), sometimes as a variety of *P. delavayi* (Finet & Gagnepain, 1904; Pan, 1979) — until Hong *et al.* (1998a). The two names describe a variable taxon accepted herein as *P. delavayi*.

The first new species of *Paeonia* from Africa (Algeria), *P. algeriensis*, was described by Chabert (1889). Owing to the lack of adequate knowledge of this peony, it was variously treated in taxonomy. On the basis of an examination of a relatively large number of herbarium specimens from 11 herbaria and subsequent statistics, we have reached the conclusion that *P. algeriensis* is morphologically distinct from all its nearby allies: *P. mascula* (including *P. russoi*), *P. corsica* and *P. coriacea*.

In his new classification, Lynch (1890) recognised 25 peony species in gardens and indicated that he had omitted four species from his monograph because they were not yet introduced into cultivation (*Paeonia corsica*, *P. obovata*, *P. delavayi* and *P. lutea*). Thus, the number of species in *Paeonia* increased to 29, according to Lynch's concept. Lynch divided the genus into three subgenera: subg. *Moutan* (DC.) Ser., subg. *Onaepia* Lindl. and subg. *Paeonia*. The subgenus *Moutan* contained only one species, *P. moutan*; subg. *Onaepia* comprised only one species in N America, *P. brownii*, with *P. californica* treated as its variety. Lynch classified peonies in subg. *Paeonia* into 23 species according to the division of their leaflets, number and width of leaf segments, the indumentum on leaves and carpels, the number of flowers on a stem, as well as the colour of leaves. Of the 25 species he recognised, *P. bakeri* and *P. barrii* were newly described by him based on cultivated peonies in gardens. The former is a synonym of *P. arietina* and the latter a superfluous name of *P. officinalis*.

based on his description and figure (fig. 32). Lynch's subdivision of *Paeonia* into three groups was followed by most later authors, and his subgeneric rank was accepted by Stebbins (1939) and Halda (1997). His species concept was essentially accepted by most later authors, e.g. Stern (1946).

One year later, Huth (1891) published the fifth monograph of *Paeonia*, following Anderson (1818), Seringe (1849), Baker (1884) and Lynch (1890). His subdivision of the genus completely differs from that of de Candolle (1824) and Lynch (1890) and was regionally based. Huth divided the genus first into two sections, sect. *Palaearticae* including all the peonies in the Old World and sect. *Nearcticae* including the two species in the New World. The first section was divided into two subsections, subsect. *Herbaceae* and subsect. *Fruticosae*, on the basis of habit. Huth included two species, *P. moutan* and *P. delavayi*, in subsect. *Fruticosae* but unfortunately he placed *P. lutea*, also a woody peony, into subsect. *Herbaceae*. Huth's system was followed only by the treatments of Handel-Mazzetti (1920) and Schipczinsky (1921). In subsect. *Herbaceae* (= subg. *Paeonia* sensu Lynch), Huth recognised just nine species (*P. lutea* excluded), a classification that differs greatly from Lynch's (1890) (recognising 25 species). His *P. corallina* (a superfluous name of *P. mascula* (L.) Mill.) encompassed six species — *P. flavescens*, *P. daurica*, *P. broteri*, *P. russoi*, *P. cambessedesii* and *P. corsica*; and his *P. peregrina* comprised five other species — *P. officinalis*, *P. villosa*, *P. humilis*, *P. cretica* and *P. banatica*.

In the *Flora de France*, Rouy and Foucaud (1893) followed Huth's (1891) species concept, recognising the two species, *Paeonia corallina* and *P. peregrina*. Under *P. peregrina* they described two taxa, which they apparently treated as two forms, but described in the same way as a species: *P. leiocarpa* based on plants from S and SW France and *P. angustata* based on peonies from the Hautes-Alpes in southeastern France.

Lomakin (1897) described two new species and one new variety of *Paeonia* from the Caucasus, *P. macrophylla* and *P. mlkosewitschii* (both from Georgia), and *P. wittmanniana* var. *tomentosa* (from SE Azerbaijan).

Gürke (1903) basically followed Huth's (1891) species concept, grouping all peonies in Europe into six species. Unlike Huth, he correctly used Miller's earlier name *Paeonia mascula* instead of *P. corallina*; he also substituted *P. feminea* for Huth's *P. peregrina*, but neither name is accurate and both refer to Linnaeus's *P. officinalis*. The remaining four species treated by Gürke (1903) are *P. coriacea*, *P. anomala*, *P. decora* and *P. tenuifolia*.

Jordan & Foureau (1903) described six new species of *Paeonia* in Europe: *P. villarsii* from the Hautes-Alpes; *P. monticola*, also from Hautes-Alpes; *P. leiocarpa* and *P. modesta* from the eastern Pyrenees; and *P. revelieri* and *P. glabrescens* from Corsica. None of these six species has been recognised by any later author.

Finet & Gagnepain (1904) published the results of their studies of Asian peonies. They described 10 species in detail with citation of herbarium specimens. *Paeonia lutea* was correctly reduced to a variety of *P. delavayi* for the first time, but their treatment of *P. obovata*, which is confined to eastern Asia, as a synonym of *P. wittmanniana*, which is endemic to the Caucasus, has not been followed by later authors. They were correct in recognising a peony from Sichuan (Kangding) as a member of *P. anomala* originally described from Siberia. This peony was later described as a new species, *P. veitchii* Lynch (1909), but is treated here as *P. anomala* subsp. *veitchii* D. Y. Hong & K. Y. Pan (Hong *et al.*, 2001a).

From 1909 to 1939 ten new species of *Paeonia* were described from China. As mentioned above, Lynch (1909) described *P. veitchii* with several flowers per stem from Sichuan. Lévillé (1915) described *P. mairei* from Yunnan and this has been recognised as a good species by all subsequent authors. Stapf (1916) described *P. willmottiae* on the basis of a plant raised from seeds from Hubei Province. Handel-Mazzetti (1920) described *P. oxypetala* from Sichuan. *Paeonia bifurcata* was described by Schipczinsky (1920) from Chongqing. Komarov (1921) described two species, *P. beresowskii* from Sichuan, soon reduced to a variety, *P. veitchii* var. *beresowskii* (Kom.) Schipcz. (1921), and *P. potaninii*, a woody peony also from Sichuan, referred herein to *P. delavayi*. Cox

(1930) described *P. woodwardii* Stapf ex Cox from Gansu Province. Stern (1931) described yet another woody peony species from Yunnan, *P. trollioides* Stapf ex Stern. Handel-Mazzetti's (1939) article deserves more discussion. First, he correctly substituted *P. lactiflora* Pall. (1776) for *P. albiflora* Pall. (1788), and thus ended the long misuse of the latter name. Second, he described the distinctive woody peony, *P. decomposita*, from northwestern Sichuan, but it was confused with *P. suffruticosa* (Stern, 1946; Fang, 1958; Pan, 1979) until the work of Hong *et al.* (1996).

Miyabe and Takeda (1910) raised *Paeonia obovata* var. *japonica* Makino (1898) to specific rank, *P. japonica* (Makino) Miyabe & Takeda, even though its morphology remains within the variability of *P. obovata*. *Paeonia kavachensis* was described as new from eastern Turkey by Aznavour (1917). It was treated as conspecific with *P. mascula* by Stern (1946) and later authors (Davis & Cullen, 1965b), which is reasonable. Mandl (1921) described the peony *P. vernalis* as new from the Far East (Ussuri). This name was recognised by Schipczinsky (1937), but reduced to synonymy with *P. obovata* by Stern (1946), a position accepted herein.

Following Huth (1891), Schipczinsky (1921) published his taxonomic synopsis of *Paeonia*, recognising two sections and two subsections. In sect. *Nearcticae* Huth, he recognised two species, *P. brownii* and *P. californica*. In sect. *Palaearticae* Huth subsect. *Fruticosae* Huth, he recognised three woody species: *P. moutan*, *P. delavayi*, within which he treated *P. lutea* as a variety following Finet and Gagnepain (1904), and *P. potaninii*. In sect. *Palaearticae* subsect. *Herbaceae* Huth, he recognised 16 species, with eight new varieties, two new forms and one new combination at varietal rank.

Thiébaud (1934) described a new peony variety from Lebanon, *Paeonia corallina* var. *kesrouanensis*, but two years later raised it to specific rank as *P. kesrouanensis* (Thiébaud, 1936). The botanical world had little knowledge of this entity until the work of Hong *et al.* (2005), who described it in detail and clarified its relationships with its allies on the basis of extensive field work and chromosome observation.

Schipczinsky (1937) recognised 15 species of *Paeonia* in the territory of the Soviet Union, which were grouped into five series: ser. 1. *Chinensis* Kom. ex Schipcz., including *P. albiflora*; ser. 2. *Obovatae* Kom. ex Schipcz., including *P. mlokosewitschii*, *P. oreogeton*, *P. obovata*, *P. vernalis* and *P. japonica*; ser. 3. *Corallinae* Kom. ex Schipcz., including *P. triternata*, *P. caucasica*, *P. wittmanniana*, *P. macrophylla*, *P. tomentosa* and *P. abchasica*; ser. 4. *Dentatae* Kom. ex Schipcz., including *P. anomala* and *P. hybrida*; and ser. 5. *Fissae* Kom. ex Schipcz., including *P. tenuifolia* and *P. biebersteiniana*. He recognised every species described at that time. Thus he restored *P. oreogeton*, which had been treated as a synonym of *P. obovata* by Baker (1884) and by Huth (1891), and *P. biebersteiniana*, which had been reduced by Busch (1901) to a variety of *P. tenuifolia*. He also raised his own variety, described earlier as *P. corallina* var. *caucasica* Schipcz. (Schipczinsky, 1921), to specific rank.

Stebbins' (1939) work, some of it with Saunders as a colleague (Saunders & Stebbins, 1938), is important in the taxonomic history of *Paeonia*. Saunders gathered together most of the known species of the genus in their nearly original, wild forms and made all possible crosses between them. Stebbins brought compatibility between species into his consideration of species relationships. Stebbins had the good fortune to study Saunders' living collection, which allowed comparison of live plants of various species, hybrids and horticultural forms. He could observe floral characters that are difficult or impossible to recognise in herbaria. Stebbins is the first author to analyse *Paeonia* characters in detail from a taxonomic viewpoint. He evaluated seven characters and concluded that sepals are the character most valuable for taxonomy in the genus. He then illustrated the sepals of eight species and four hybrids. Lynch's (1890) system of three subgenera was accepted by Stebbins who also clarified the relationships between a number of species in *Paeonia*. He placed *P. albiflora* (= *P. lactiflora*), *P. emodi*, *P. anomala* and *P. veitchii* together on the basis of the caudate state of all sepals, which distinguishes the species group from all others in subg. *Paeonia*. He correctly reduced *P. mlokosewitschii* to synonymy with *P. triternata* (= *P. daurica*), *P. veitchii* to synonymy with *P. anomala*, and *P. japonica* to synonymy with *P. obovata*.

Stern (1940) substituted the name *Paeonia clusii* Stern for *P. cretica* Tausch for the peony in Crete, clarifying the long-standing confusion of the names *P. cretica* Sabine (Lindley, 1824) and *P. cretica* Tausch (1828). Stearn (1941) described *P. rhodia* from Rhodes as new, and stated that it was diploid with $2n = 10$, and similar to *P. clusii*. The taxon was treated later by Tzanoudakis (1977) as *P. clusii* subsp. *rhodia* (Stearn) Tzanoud.

Stern's two works (Stern, 1943, 1946) are very important contributions to the taxonomy of *Paeonia*. In his first work, Stern (1943) gave an outline of his classification of *Paeonia*, dividing the genus into three major groups, following Lynch (1890) but using the lower rank of section instead of subgenus: sect. *Moutan* for woody peonies, sect. *Onaepia* for the New World peonies, and sect. *Paeon* (= *Paeonia*) for the herbaceous peonies of the Old World. Section *Paeonia* was divided into two subsections: subsect. *Foliolatae*, including the species with distinct entire leaflets; and subsect. *Dissectifoliae*, including the species with much-dissected leaflets. According to his concept, subsect. *Foliolatae* contains nine species groups: the *Wittmanniana* group from the Caucasus region; the *Russi* group from islands in the western Mediterranean; the *Mascula* group from continental Europe; the *Broteri* group from southern Spain and Portugal; the *Obovata* group from eastern Asia; the *Mairei* group from western China; the *Arietina* Group from southeastern Europe and Asia Minor; the *Coriacea* group from southern Spain, Morocco and Algeria; and the *Lactiflora* Group from northeastern Asia and northern India. Stern's (1946) second work was a comprehensive monograph of *Paeonia*, though he modestly called it a study. Here, he proposed his classification system with keys. In total, 33 species and 14 varieties were recognised and described. Coloured plates illustrated 15 taxa (14 species and one variety) and 32 ink drawings were presented. In addition to a description, under each species and variety he cited the synonyms and listed those specimens examined, mostly from the herbarium of the Royal Botanic Gardens, Kew (K).

Stern analyzed seven sets of characters: carpels, hairs, flowering status and date, number of flowers on a stem, sepals, disk and seeds. He did not consider the presence or absence of hairs on carpels so significant as to distinguish species; instead, he gave peonies that differed in this respect varietal rank. Stern considered the shape and number of carpels only in particular cases. He did not consider differences in indumentum on the back of leaves to justify the separation of species. He noticed the presence of bristles along nerves on the upper side of leaves in *P. lactiflora*, *P. emodi*, *P. anomala* and *P. veitchii* (= *P. anomala* subsp. *veitchii*). He also noticed the ascending state of petals at anthesis (forming a cup-shaped corolla) in *P. peregrina*, *P. japonica* (= *P. obovata*), *P. potaninii* var. *trolioides*, *P. brownii* and *P. californica*. As a horticulturist, Stern noted the difference in dates of flowering in cultivation, e.g. between *P. cambessedesii* (April) and *P. russoi* (May), or between *P. anomala* (May) and *P. veitchii* (June). *Paeonia veitchii*, *P. lactiflora* and *P. emodi* were found to bear several flowers on a stem, which he considered a primitive character, in agreement with Saunders & Stebbins (1938). Although the character of sepals was highly valued for taxonomy by Stebbins (1939), Stern (1946) did not use it. The floral disk was used in the key to sections and subsections to distinguish sect. *Onaepia* (produced as fleshy lobes at the base of carpels) from sect. *Paeonia* (not produced as conspicuous outgrowths), and to distinguish subsect. *Vaginatae* (produced as a thin leathery sheath that at first completely envelops the carpels) from subsect. *Delavayanae* (produced as conspicuous fleshy lobes around the base of carpels). Stern was not sure of Stebbins' (1939) observation on the wrinkling of the seed-coat, but he distinguished some species by seed size.

Stern & Taylor (1951) described a woody peony from southeastern Xizang (Tibet) as *Paeonia lutea* var. *ludlowii*. Two years later, they republished this new taxon (Stern & Taylor, 1953). In 2000 and 2003, I found this woody peony growing in front of the Natural History Museum in London and at the Royal Botanic Gardens, Kew. The proper name of this splendid woody peony, *P. ludlowii* (Stern & G. Taylor) D. Y. Hong, was established in 1997 (Hong, 1997a), where its distinctness from its allies and its designation as the tallest woody peony were determined.

Paeonia lithophila was described as new with an illustration by Kotov (1956) based on four collections from Tauria, Ukraine. We failed to find any distinct difference between this new species and *P. tenuifolia* L. from the description and illustration, and from the specimens collected near the locality of the type specimen.

Fang (1958) published a taxonomic revision of Chinese peonies following Stern's (1946) system. He described 12 species, of which three were considered to be new. Unfortunately, none of them were really new taxa. *Paeonia szechuanica* W. P. Fang was described due to the confusion of *P. decomposita* Hand.-Mazz. with *P. suffruticosa*, and thus it is a synonym of *P. decomposita* (Hong *et al.*, 1996). *Paeonia yunnanensis* W. P. Fang and *P. yui* W. P. Fang were actually only cultivated forms of *P. suffruticosa* and *P. lactiflora*, respectively.

Fletcher (1959) described the first new herbaceous peony from Tibet, *Paeonia sterniana*. Its specific status has not been challenged by any taxonomist except Halda (1997), who treated it as *P. emodi* subsp. *sterniana* (H. R. Fletcher) Halda. The taxon is accepted at the species level herein.

Also in 1959, two new species from the Caucasus were described by Ketzchoveli (Ketskoveli, 1959). *Paeonia majko*, which was described as similar to *P. hybrida* and *P. anomala* in central Asia, and *P. carthalinica*, which was said to be very similar to *P. tenuifolia*. Both correspond to *P. × saundersii* and *P. tenuifolia*, respectively, herein.

I am deeply impressed by Kemularia-Nathadze's (1961) work. Her taxonomic system of the genus *Paeonia* comprises five sections with 17 series: sect. *Flavonia* with yellow flowers, including four series, ser. *Lactiflorae*, ser. *Luteae*, ser. *Macrophyllae* and ser. *Wittmannianae*; sect. *Moutan* (as shrubbery) with a single series, ser. *Suffruticosae*; sect. *Onaepia* (USA, fleshy leaves) also with a single series, ser. *Brownii*; sect. *Paeon* (with double-triple ternate leaves) including seven series, ser. *Obovatae*, ser. *Broteri*, ser. *Arietinae*, ser. *Masculae*, ser. *Mairei*, ser. *Russi* and ser. *Delavayanae*; and sect. *Sternia* ("triterately pinnate" leaves) with five series, ser. *Hybridae*, ser. *Fissae*, ser. *Peregrinae*, ser. *Anomala* and ser. *Officinales*. It is clear from this synopsis that Kemularia-Nathadze emphasised flower colour and leaf characters to the exclusion of other traits. She placed shrubs and herbs together in the same section: ser. *Delavayanae* is woody whereas the other series in sect. *Paeon* are herbaceous; ser. *Luteae* is woody whereas the other series in sect. *Flavonia* are herbaceous. The second part of her work describes 13 species in the Caucasus. Not only did she recognise all the species already described from the Caucasus, but also she recognised additional taxonomic diversity with the three new species, *P. lagodechiana* Kem.-Nath., *P. ruprechtiana* Kem.-Nath. and *P. steveniana* (Stev.) Kem.-Nath., which are assigned to *P. daurica* subsp. *mlokosewitschii*, *P. daurica* subsp. *coriifolia*, and *P. daurica* subsp. *macrophylla*, respectively herein.

Cullen & Heywood (1964a, 1964b) revised the taxonomy of *Paeonia* in Europe. Ten species were recognised, basically following Stern's (1946) treatment of species. However, these authors adopted a broader sense for *P. officinalis* and *P. mascula*. In the former taxon, they included four subspecies: subsp. *officinalis*, subsp. *banatica* (Rochel) Soó, subsp. *humilis* (Retz.) Cullen & Heywood and subsp. *villosa* (Huth) Cullen & Heywood. In the latter, they placed three subspecies: subsp. *mascula*, subsp. *russoi* (Biv.) Cullen & Heywood and subsp. *arietina* (G. Anderson) Cullen & Heywood. Their treatment of *P. arietina* as a subspecies of *P. mascula* and their inclusion of Crete in the distribution range of *P. mascula* subsp. *arietina* (= *P. arietina* G. Anderson) clearly imply that they did not understand the entity.

Davis & Cullen (1965a, 1965b) later studied *Paeonia* in Turkey and revised the taxonomy of *Paeonia* in the region. Six species were recognised: *P. daurica*, *P. kesrouanensis*, *P. mascula* (with two subspecies, subsp. *mascula* and subsp. *arietina*), *P. peregrina*, *P. rhodia* and *P. turcica*. They cited herbarium specimens, mostly collected by Davis and his coworkers, which makes the treatment highly valuable. They described *P. turcica* as new based solely on its difference from *P. kesrouanensis* in the total length of styles and stigmas, a distinction not maintained herein.

Tzanoudakis (1977) published his Ph.D dissertation on Greek *Paeonia*. In this outstanding work, he observed the chromosomes of 34 populations representing the four species he recognised. He

found both diploids ($2n = 10$) and tetraploids ($2n = 20$) in *P. clusii*, and a diploid *P. mascula* subsp. *russoi* in the Ionian islands and the Akarnania Province of Greece (see also Tzanoudakis, 1983). One species and two subspecies were described as new by Tzanoudakis, *P. parnassica*, *P. mascula* subsp. *hellenica* and subsp. *icarica*. In addition, he reduced *P. rhodia* to a subspecies, *P. clusii* subsp. *rhodia* (Stearn) Tzanoud.

Pan (1979) revised the taxonomy of *Paeonia* in China, recognising two sections, sect. *Moutan* DC. and sect. *Paeonia*. Three species were described in sect. *Moutan*, and eight species in sect. *Paeonia*, of which, *P. sinjiangensis* K. Y. Pan was described as new because its roots are carrot-shaped rather than tuberous as in *P. anomala*, as described by Schipczinsky (1937) in *Flora USSR* and Gamaulova (1961) in *Flora Kazakhstan*. However, the roots of *P. anomala* are actually carrot-shaped and so *P. sinjiangensis* was later reduced to a synonym of *P. anomala* (Hong & Pan, 2004).

Stearn and Davis' *Peonies of Greece* (1984) is an outstanding contribution to *Paeonia* studies. The book is comprehensive, covering morphology, cytology, geography and the enumeration of taxa. Five species were recognised: *P. peregrina*, *P. clusii*, *P. rhodia*, *P. parnassica* and *P. mascula* (with four subspecies, subsp. *mascula*, subsp. *hellenica*, subsp. *russoi* and subsp. *triternata* (= *P. daurica*)). They provided coloured illustrations and ink drawings of most taxa. The most impressive aspect of this book may be its 'Historical Introduction', in which they presented the long history of studies on *Paeonia* from ancient Greece to modern times with 14 figures (mostly woodcuts). Particularly informative is the review of the history before Linnaeus' (1753) historic work. For example, they introduced the history of Clusius' discovery of a white-flowered peony (*P. clusii*) in Crete (1984: 29). Clusius' sixteenth century work, which took him 40 years to complete, recorded 14 kinds of peonies (now *P. mascula* subsp. *mascula*, *P. officinalis* subsp. *officinalis*, *P. officinalis* subsp. *microcarpa*, *P. clusii* and *P. peregrina*).

A new taxonomic system for the genus *Paeonia* was proposed by Uspenskaya (1987), based on the analysis of 24 characters and 17 species. Five sections were recognised: sect. *Moutan* comprising two subsections, subsect. *Vaginatae* and subsect. *Delavayanae*; sect. *Albiflorae* with one species, *P. lactiflora*; sect. *Onaepia*; sect. *Palaearticae*, comprising three subsections and four series, subsect. *Flavonia* (ser. 1. *Macrophyllae* and ser. 2. *Wittmanniana*); subsect. *Foliolatae* (ser. 1. *Masculae* and ser. 2. *Arietinae*), and subsect. *Obovatae*; and sect. *Paeonia* with three series, ser. *Officinalis*, ser. *Anomala* and ser. *Tenuifoliae*. Her samples for the study are questionable because the 17 species are all from the Soviet Union territory except for four species (*P. suffruticosa*, *P. lutea*, *P. delavayi* and *P. veitchii*). Among these four species, *P. lutea* and *P. delavayi* are conspecific, whereas *P. veitchii* is a subspecies in *P. anomala*. Furthermore, the two species of the New World were not included in her samples.

During the 1990s, a number of authors, in addition to the present author, devoted their energy to studies of *Paeonia* in China. Haw & Lauener (1990) divided *P. suffruticosa* into three subspecies, subsp. *suffruticosa*, subsp. *spontanea* (Rehder) S. G. Haw & Lauener and subsp. *rockii* S. G. Haw & Lauener, which were circumscribed clearly by descriptions, citation of herbarium specimens, typification, and illustrations of the leaves. In the same year, *P. altaica* was described as new by Dai and Ying (1990) from the Altai mountains in China. The new species was stated to differ from *P. sinjiangensis* (= *P. anomala*) in having two to four flowers per stem and from *P. veitchii* (= *P. anomala* subsp. *veitchii*) in having flowers that are larger in diameter (10–18 cm rather than 5–10 cm) and the petals entire.

HONG Tao and his co-workers described several new woody species during the 1990s. In their first paper (T. Hong *et al.*, 1992), *Paeonia ostii* was described as a new tree peony that is widely cultivated in China for medicine; *P. jishanensis* was described as a new species from Jishan County, Shanxi Province, and was stated to differ from *P. suffruticosa* var. *spontanea* Rehder in having white flowers and non-petaloid stamens; *P. yananensis* was based on a specimen from a forest near the Peony Garden in Yan'an, Shaanxi Province; and *P. suffruticosa* subsp. *rockii* S. G. Haw & Lauener was raised to specific rank, but this new combination was invalid. The valid

combination was made by the present author (Hong, 1998): *P. rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong. In a second paper (Hong & Osti, 1994), T. Hong and his co-workers found that their *P. jishanensis* was the same entity as *P. suffruticosa* var. *spontanea* Rehder. They tried to accommodate this by raising the latter taxon to specific rank, *P. spontanea* (Rehder) T. Hong & W. Z. Zhao, whereas *P. jishanensis* was reduced to a synonym of *P. spontanea*. This treatment is against the Article 11.2 of the International Code of Botanical Nomenclature (Vienna Code, 2006: 21), which states "In no case does a name have priority outside the rank in which it is published." A third paper (T. Hong & Dai, 1997) contains descriptions of two new species, *P. ridleyi* Z. L. Dai & T. Hong and *P. baokangensis* Z. L. Dai & T. Hong. The type locality of *P. ridleyi* is near that of *P. qiui* Y. L. Pei & D. Y. Hong (1995), and we could not find any significant difference between these two taxa. The type specimen of *P. baokangensis* was apparently not from the mountain Chefengou at an altitude of 1600 m as the protologue stated, but instead, according to a personal communication from Mr Z. L. Dai (the co-author of this botanic name), from a plant cultivated at the side of Mr QI Xing-Hua's house in the Houping Township of Baokang County, which was a hybrid between *P. rockii* and *P. qiui*. The two parents grew naturally on nearby mountains and were introduced into quite a few farm yards in this township as ornamentals.

Halda's (1997) taxonomic system of *Paeonia* should be mentioned here. At the subgeneric level, he followed Lynch (1890), recognising three subgenera, but he further recognised three sections with six subsections in subg. *Paeonia*, one section in subg. *Onaepia*, and two sections in subg. *Moutan*. He gave a very short description and type for each taxon, but no subordinate components. In addition, he made 14 new combinations and described two hybrids, giving no explanation but short descriptions. One year later, he added one subgenus, subg. *Albiflora* (Salm-Dyck) Halda; two sections, sect. *Emodi* and sect. *Tenuifolia*; and one subsection, subsect. *Masculae*; again without explanation (Halda, 1998). Six years later, Halda published his taxonomy with 34 colour paintings and 33 ink drawings (Halda, 2004). Here, he used his taxonomic system for *Paeonia*, recognising four subgenera, six sections and four subsections: subg. *Moutan*, including sect. *Moutan* and sect. *Delavayanae*; subg. *Onaepia* with only one species, *P. brownii*; subg. *Albiflora* with only one species, *P. lactiflora*; and subg. *Paeonia*, including sect. *Paeonia* (subsect. *Paeonia*, subsect. *Masculae*, subsect. *Anomalae* and subsect. *Obovatae*), sect. *Tenuifoliae*, sect. *Emodi* and sect. *Flavonia*.

Halda (2004) recognised only 25 species in *Paeonia*, with three infrageneric hierarchies above specific rank. In the infraspecific ranks, he recognised 33 subspecies and 14 varieties (Halda, 1997, 2004). This multi-tiered system seems tedious and pedantic. Hong and his colleagues had already shown (Hong *et al.*, 1998a), based on population sampling and statistics that yellow and red petals in *P. delavayi* and *P. lutea* were a polymorphism, and that the differences in leaf segments between *P. delavayi* and *P. potaninii* were statistically insignificant (Hong *et al.*, 1998a). Haw (2001b) made a positive commentary on our treatment of *P. lutea* and *P. potaninii* as synonyms of *P. delavayi*. However, Halda (2004) continued to recognise them as separate species without explanation.

The peony of Crete and Karpathos is clearly conspecific with that of Rhodos. The two regional forms were treated as conspecific subspecies, *P. clusii* subsp. *clusii* and *P. clusii* subsp. *rhodia* (Stearn) Tzanoud., by both Tzanoudakis (1977) and Phitos (2002). Yet Halda (2004) still treated them as two species, *P. clusii* and *P. rhodia*. On the other hand, Halda treated *P. californica* as a subspecies in *P. brownii*, ignoring their distinct differences and Stebbins' (1938b) excellent explanation and illustration of these two distinct species. *Paeonia ludlowii* (Stern & G. Taylor) D. Y. Hong (*P. lutea* var. *ludlowii*), a woody peony in Xizang (Tibet), is distinctly different from *P. lutea* (= *P. delavayi*) in leaves, number of carpels, size of follicles, and also reproductive behaviour (Hong, 1997a). Despite this, Halda still recognised *P. lutea* var. *ludlowii*, disregarding Haw's (2001b) commentary. There were more cases of Halda's perplexing treatments, e.g. *P. arietina* as a subspecies of *P. mascula*, or *P. cambessedesii* as a synonym of *P. corsica*.

Curiously, Halda (2004) did not cite many significant references for *Paeonia*, e.g. Haw (2001a, 2001b), Phitos (2002), Cesca *et al.* (2001). Not long before Halda's work (2004), we had published a number of articles on taxonomic revisions of *Paeonia* in international journals (Hong, 1997a, 1997b; Hong & Pan, 1999a; Hong & Zhou, 2003; Hong *et al.*, 1996, 1998a, 2001c). None of these publications were mentioned by Halda or included in his bibliography.

Another concern with Halda's (2004) work was its numerous factual discrepancies. The colour plate of *P. officinalis* subsp. *officinalis* (p. 49) is a misidentification and actually refers to *P. peregrina* Mill., because the illustration shows that the plant is entirely glabrous except for its carpels and that the leaf segments are tooth-lobed. In *P. lactiflora*, the sepals are all or mostly caudate at the apex, but figure 35 (2004: 131) shows the sepals rounded at the apex; the terminal flower blooms first and the third flower from the top blooms second, and thus his colour plate (2004: 133) is wrong in respect of the developmental order of the flowers. Taking pages 51, 53 and 54 as an example, "*P. officinalis* subsp. *humilis* (Retz.) Cullen & Heywood (1964a)" and "*P. officinalis* subsp. *villosa* (Huth) Cullen & Heywood (1964a)", which Halda cited as valid names, are actually synonyms of *P. officinalis* subsp. *microcarpa* (Boiss. & Reut.) Nym. (Nyman, 1878) and *P. officinalis* subsp. *huthii* Soldano (1993), respectively. The work contained a high rate of bibliographic and citation errors.

2.2 COMMENTARY ON THE TAXONOMIC HISTORY OF PAEONIA

2.2.1 TAXONOMIC SYSTEMS FOR PAEONIA

Since the discovery of the peony in the New World (Hooker, 1829), a number of taxonomic systems of *Paeonia* have been proposed (Table 2.1).

Salm-Dyck's (1834) system was based on the characters of habit, number of flowers on a stem, division of leaflets, shape of leaf blades and indumentum of leaves. The latter three characters are rather variable in *Paeonia*, and can be used for distinguishing species only in some cases. This system has no followers.

Kemularia-Nathadze (1961) established the section *Flavonia* in *Paeonia* based solely on yellow flowers. My co-workers and I (Hong *et al.*, 1998a; Hong & Zhou, 2003) have demonstrated that, as a polymorphism, individuals with yellow flowers can coexist with those possessing flowers of red, pink, white and many other colours within a single population (also see Fig. 3.13). Furthermore, in Kemularia-Nathadze's system some distantly related species, e.g. woody *P. lutea* (= *P. delavayi*) and herbaceous *P. lactiflora* and *P. macrophylla* (= *P. daurica* subsp. *macrophylla*), were placed in the same section, whereas species known to be closely related, e.g. *P. lutea* and *P. delavayi* (which are actually conspecific) or *P. arietina* and *P. officinalis*, were separated into different sections.

Uspenskaya's (1987) system was similar to that of Kemularia-Nathadze (1961) for *Paeonia*, but substitutes sect. *Albiflora*, sect. *Palaearticae* and sect. *Paeonia* for sect. *Flavonia*, sect. *Paeon* and sect. *Sternia*. Sect. *Albiflora* contained a single species, *P. lactiflora*, which is closely related to *P. anomala* (which includes *P. veitchii*). One major difference between them is the presence of cartilaginous thickening and minute spines on the margin of leaf blades in *P. lactiflora*. Uspenskaya's system was also questionable because only 17 species were sampled, nearly all from the former Soviet Union.

Halda (1997) adopted Lynch's system, but added one more subgenus, subg. *Albiflora*, to his 2004 system, which increased its artificiality.

Huth's (1891) two groups were different from Seringe's (1849), though both of these botanists recognised two major groups in *Paeonia*.

The subdivision of *Paeonia* into three major groups seems to be natural, no matter the infrageneric rank applied. Molecular data also support three groups (see Chapter 4: Taxonomic

TABLE 2.1

The subdivision of *Paeonia* in different taxonomic systems.

Two-group systems	Seringe (1849) Baker (1884)	subg. <i>Moutan</i> and subg. <i>Paeonia</i>
	Huth (1891) Schipczinsky (1921)	sect. <i>Palaearticae</i> and sect. <i>Nearcticae</i>
Three-group systems	Lynch (1890) Stebbins (1939) Halda (1997)	subg. <i>Moutan</i> , subg. <i>Onaepia</i> and subg. <i>Paeonia</i>
	Stern (1943, 1946)	sect. <i>Moutan</i> , sect. <i>Onaepia</i> and sect. <i>Paeonia</i>
Four-group system	Halda (2004)	subg. <i>Moutan</i> , subg. <i>Onaepia</i> , sect. <i>Paeonia</i> and subg. <i>Albiflora</i>
Five-group systems	Kemularia-Nathadze (1961)	sect. <i>Flavonia</i> , sect. <i>Moutan</i> , sect. <i>Onaepia</i> , sect. <i>Paeon</i> and sect. <i>Sternia</i>
	Uspenskaya (1987) (peonies in the New World not included)	sect. <i>Moutan</i> , sect. <i>Albiflora</i> , sect. <i>Onaepia</i> , sect. <i>Palaearticae</i> and sect. <i>Paeonia</i>
Eight-group system	Salm-Dyck (1834)	sect. <i>Suffruticosae</i> , sect. <i>Albiflorae</i> , sect. <i>Corallinae</i> , sect. <i>Macrocarpae</i> , sect. <i>Microcarpae</i> , sect. <i>Compactae</i> , sect. <i>Lobatae</i> and sect. <i>Laciniatae</i>

synopsis of the genus *Paeonia*). For these reasons, we take only the systems of Baker (1884), Huth (1891), Lynch (1890), Stebbins (1939), Halda (1997) and Stern (1943, 1946) into consideration for our secondary subdivision of *Paeonia*.

Baker's (1884) subgenus *Moutan* contains only one species, and he divided subg. *Paeonia* into three sections based on two characters: the carpels glabrous or tomentose, and the follicles erect-arcuate or spreading from their base when mature. As later explained in our Chapter 3: Characters and their variations, the presence or absence of indumentum on carpels is not a reliable character, even to distinguish species in some cases. Baker placed distantly related species, e.g. *P. lactiflora*, *P. coriacea* and *P. humilis* (= *P. officinalis* subsp. *microcarpa*), together in the same section, while putting closely related species, e.g. *P. humilis* and *P. officinalis*, into different sections. His system was too simple for the diversity clearly evident in the genus.

Huth (1891) divided his *Paeonia* sect. *Palaearticae* into two groups, *Herbaceae* and *Fruticosa*. According to his system, most species fall into *Herbaceae*, in which he used several key characters to distinguish species, but no formal groups were established. Surprisingly, he placed *P. lutea* (= *P. delavayi*), a woody species, in his group *Herbaceae*.

Lynch's (1890) *Paeonia* subg. *Moutan* included three species, while subg. *Onaepia* contains only one species. He included all the remaining 23 species that he recognised in subg. *Paeon*. He did not assign species to subgroups, instead distinguishing species only by the use of key characters.

Stern (1943, 1946) was the first author to establish formal infrasectional subdivision to the subsectional level in *Paeonia*. He divided sect. *Moutan* into two subsections, according to the texture and height of disk, with *P. delavayi*, *P. lutea* and *P. potaninii* in subsect. *Delavayanae* Stern, and *P. suffruticosa* in subsect. *Vaginatae* Stern. This treatment has been accepted by most later authors (Fang, 1958; Pan, 1979; Uspenskaya, 1987), and these relationships have been confirmed by molecular data (Zhao *et al.*, 2004; Zou *et al.*, 1999). Stern divided the Old World herbaceous section, sect. *Paeon* into two subsections: subsect. *Foliolatae* Stern and subsect. *Dissectifoliae* Stern. In subsect. *Foliolatae*, Stern (1943) recognised nine groups. In subsect. *Dissectifoliae*, he recognised the *Peregrina* group; the *Officinalis* group, including *P. officinalis*, *P. humilis* (= *P. officinalis* subsp. *microcarpa*) and *P. clusii*; the *Tenuifolia* group; and the *Anomala* group, including *P. anomala*, *P. anomala* var. *intermedia* (= *P. intermedia*) and *P. veitchii* (= *P. anomala* subsp. *veitchii*). According to Stern's (1943, 1946) system, the *Arietina* group, the *Officinalis* group and *P. banatica* in the *Mascula* group belonged to different subsections. We have found, however, that morphological and molecular data both indicate that these two groups and *P. banatica* are very closely related, forming a species complex. We have also found that Stern's *Wittmanniana* group, *Russi* group (excluding *P. corsica*) and *Mascula* group (excluding *P. banatica* and *P. broteri*) form a species complex. Any attempt to separate them into different groups seems unjustifiable. Therefore, Stern's (1946) subdivision for sect. *Moutan* is taxonomically acceptable, whereas his sect. *Paeonia*, where subdivision is difficult because of hybridisation (Sang *et al.*, 1995, 1997a), is not acceptable.

2.2.2 SPECIES PROBLEMS

2.2.2.1 Identity of specific names

Quite a few names in *Paeonia* have been taxonomically misunderstood, with problems for identity or confusion with other names.

(1) *Paeonia decomposita* was described as new by Handel-Mazzetti (1939: 39) on the basis of a specimen from northwestern Sichuan. He indicated that the leaves of this species were “ternate, partibus 2–3 jugo pinnatis et media interdum bipinnata.....” and “affinis *P. suffruticosa* Andr. foliis multo minus composites et foliolis perpaucilobatis diversae.” (ternate, with segments 2–3-paired and pinnate and the central one sometimes bipinnate.....” and “affined to *P. suffruticosa* Andr., but differing with the leaves having more leaflets and leaflets fewer lobes.”) According to Handel-Mazzetti's description, *P. decomposita* is a woody species distinctly different from *P. suffruticosa*. However, Stern (1946) did not recognise *P. decomposita* as a species, instead treating it as a synonym of *P. suffruticosa*. Following Stern, Fang (1958) also synonymised *P. decomposita* and described the woody peony from Barkam, northwestern Sichuan, near the type locality of *P. decomposita*, as a new species, *P. szechuanica* W. P. Fang. This treatment was followed by Pan (1979) and Hong (1992). This confusion was finally cleared up when I examined the type specimen of *P. decomposita* at UPS (Hong *et al.*, 1996), reducing *P. szechuanica* to a synonym of *P. decomposita*. *Paeonia decomposita* is recognised herein as a species of woody peony that is distinct from *P. suffruticosa* and *P. rockii* in having many more leaflets (29–63), a disk that envelops the carpels up to halfway at anthesis, and totally glabrous carpels.

(2) Also accepted in our treatment, *Paeonia intermedia* C. A. Mey. was described as new on the basis of specimens from the Altai in central Asia. The taxon was subsequently variously treated as: *P. anomala* var. *hybrida* f. *intermedia* (C. A. Mey.) Trautv. (1860), *P. anomala* subsp. *intermedia* (C. A. Mey.) Trautv. (1904), *P. anomala* var. *intermedia* (C. A. Mey.) O. & B. Fedtsch. (1905), and *P. hybrida* var. *intermedia* (C. A. Mey.) Krylov (1901). As a consequence, the specific names *P. anomala*, *P. intermedia* and *P. hybrida* had long been confused. Schipczinsky (1937) and Gamaulova (1961) recognised two species under the names *P. anomala* and *P. hybrida* and confused the differences between them, describing them both as having tuberous roots. Even

Stern (1946) recognised only one species, *P. anomala*, in which two varieties were separated: var. *anomala* with glabrous carpels and var. *intermedia* with tomentose carpels. Stern (1946) considered *P. hybrida* to be an ambiguous name and did not attempt to clarify the situation. Pan (1979) described *P. sinjiangensis* as a new name for the taxon unaware of this confusion, particularly of the differences in roots between *P. anomala* and *P. intermedia*. After extensive field work in the Altai and the Tianshan ranges in central Asia, and after examination of the type specimens of *P. anomala* L., *P. hybrida* Pall. and *P. intermedia* C. A. Mey., we (Hong & Pan, 2004) concluded that *P. hybrida* is a superfluous name of *P. tenuifolia* L., and that *P. anomala* has carrot-shaped roots, with the sepals mostly caudate at the apex, whereas *P. intermedia* has tuberous or fusiform roots, with the sepals mostly rounded at the apex. We indicated the distinct differences between these two species, and also their different ecological preferences.

(3) *Paeonia corsica* Sieber ex Tausch (1828), which had long been confused with *P. mascula*, *P. cambessedesii* and others, is another example of confused identity in *Paeonia*. The species was described as new on the basis of a specimen from Mt Cagna, Corsica, a Mediterranean territory of France. Its carpels were glabrous and the leaves glabrous beneath. The name *P. corsica* had been neglected by most later authors, and its relationship to other names and taxa remained confused. It was treated by Cullen & Heywood (1964a, 1964b) and by Akeroyd (1993) as *P. mascula* subsp. *russoi*, but the peony was described as a new species, *P. morisii*, by Cesca, Bernardo and Passalacqua (2001). The number of synonyms for the entity is, surprisingly, at least 30. As a result of field observations, population sampling, examination of a large number of herbarium specimens and subsequent statistical analysis, we (Hong & Wang, 2006) found that the peony on Mt Cagna is extremely polymorphic and that Sieber's peony represents just one of its numerous forms. We also indicated that the variable *P. corsica* is distinct from the related taxa, *P. mascula* (including subsp. *russoi*), *P. cambessedesii* and *P. coriacea*. *Paeonia corsica* is considered a distinct species in our taxonomic treatment of the genus.

(4) Recently, we (Hong & Castroviejo, 2005) determined that *P. lusitanica* Mill. is a valid name with a clear description by Miller (1768), and not ambiguous as Stern (1946) stated. In our opinion, *P. broteri* Boiss. & Reut. (1842) is a superfluous name and should be replaced by *P. lusitanica* Mill. (1768). Considering the wide use of the name *P. broteri*, however, we have proposed (Hong & Castroviejo, 2005) that *P. broteri* be conserved against *P. lusitanica*. (This proposal has been recommended by the Nomenclature Committee for Vascular Plants with a vote of 18–0: Taxon 56(2): 591 (2007)).

In the history of *Paeonia* taxonomy, quite a few specific names have been neglected (dropped out of use) and the species misidentified for long periods.

Paeonia lactiflora Pall. (1776), which is widely distributed and widely cultivated as both an ornamental and a Chinese medicine, was called *P. albiflora* Pall. (1788), a superfluous name, until *P. lactiflora* was restored by Handel-Mazzetti (1939).

Paeonia mascula (L.) Mill. (1768) is clearly a valid name because Linnaeus (1753) described it as a variety of *P. officinalis*, which was effectively published. Miller (1768) raised this peony to specific rank with a clear description. The peony is widely distributed in the Mediterranean and W Asia, from Spain to Iraq, but it became known as *P. corallina* Retz. (1783). The name *P. mascula* (L.) Mill. disappeared for almost two centuries, from 1768 to 1943, when Stern restored it. Even the authors of monographs and revisions used *P. corallina* Retz. (Willdenow, 1799; de Candolle, 1818, 1824; Anderson, 1818; Boissier, 1867; Baker, 1884; Lynch, 1890; Huth, 1891; Schipczinsky, 1921; Stebbins, 1939).

Paeonia peregrina was described by Miller (1768) on the basis of a plant from "the Levant" (Istanbul, Turkey). However, Anderson (1818) included plants from S and SE France (*P. officinalis*) in *P. peregrina*, treating the real *P. peregrina* Mill. as a new species, *P. decora*. Unfortunately, Anderson's treatment of *P. peregrina* and *P. decora* was followed by those of de Candolle (1824),

Baker (1884), Lynch (1890), Huth (1891) and Schipczinsky (1921). The concepts of *P. peregrina*, *P. officinalis*, *P. decora* and *P. arietina* were confused for 100 years until Stapf (1918) indicated the source of confusion and illustrated the true *P. peregrina* Mill.

Clearly, mistaken identity is a serious problem in *Paeonia* taxonomy. The major cause may be that authors, particularly those of monographs, e.g. Anderson (1818) and Stern (1946), did not pay enough attention to protologues and their relevant materials (type specimens and figures).

2.2.2.2 Species concept and delimitation

When defining species, previous authors of *Paeonia* taxonomy seem tempted by two extremes. One group, well represented by Schipczinsky (1937) and Kemularia-Nathadze (1961), describes species on the basis of minute differences that were actually polymorphisms, i.e. diverse genotypes within a population, and modifications. At the other extreme, represented by Huth (1891) and Fiori (1898), two to several species may be lumped as a single-species concept.

Schipczinsky (1937) recognised 15 species of *Paeonia* within the Soviet Union, nine of them in the Caucasus. He distinguished between *P. obovata*, *P. japonica*, *P. vernalis* and *P. oreogeton* (all just one species, *P. obovata*, see Hong *et al.*, 2001c), between *P. triternata* (= *P. daurica*), *P. wittmanniana*, *P. mlokosewitschii*, *P. macrophylla*, *P. tomentosa*, *P. abchasica* and *P. caucasica* (all just one species, *P. daurica*, see Hong & Zhou, 2003), and between *P. tenuifolia* and *P. biebersteiniana* (just one species, *P. tenuifolia*, see Hong & Zhou, 2003).

Kemularia-Nathadze (1961) went further, recognising 13 species in the Caucasus. She separated *P. mlokosewitschii* Lomakin and *P. lagodechiana* Kem.-Nath. from the same locality, on the basis of differences in the colour of petals, stigmas, anthers and filaments and in the form of leaflets. We have shown that the peony at this site is extremely variable in the colour of its floral parts and also in the form of its leaflets (Hong & Zhou, 2003).

Kemularia-Nathadze (1961) distinguished *P. lagodechiana* (a superfluous name of *P. mlokosewitschii*) from *P. caucasica* (Schipcz.) Schipcz. on the basis of petal colour (pink versus red) and petal form (obovate, cuneate and concave versus ovate or obovate, obviously concave) and leaflet shape (elliptic or oblong-elliptic versus oblong-obovate or ovate). These subtle differences are within the range of continuous variation in a single species. The only real difference between the two “species” would be in the indumentum: *P. lagodechiana* is puberulous or glabrous on the lower surface of its leaves, whereas *P. caucasica* is sparsely villous or glabrous. In a world of minor, graduated differences, taxonomic extremists might split a species on the basis of a difference in a single, statistically insignificant character. Under their pens, the number of species could dramatically increase, with Kemularia-Nathadze splitting *P. daurica* Andrews in the Caucasus into nine species.

But extreme lumpers also create taxonomic problems in *Paeonia*. For example, Huth’s version of *P. anomala* (1891) included *P. hybrida* Pall., *P. intermedia* C. A. Mey. and *P. emodi* Wall. ex Royle. By contrast, we have found that *P. intermedia* C. A. Mey. is a distinct species (Hong & Pan, 2004), clearly different from *P. anomala* in root and sepal morphology, and in ecological preference (we place them in separate subsections); *P. hybrida* Pall. is a synonym of *P. tenuifolia* L.; and *P. emodi*, distributed in the western Himalayas, differs distinctly from *P. anomala* in having fewer than 30 (as opposed to 70–100) leaflets or segments, mostly single carpels, less frequently two (as opposed to 3–5) carpels, and flowers white (as opposed to rose or red). Thus, we determined that Huth had lumped four species into one.

Another example is *P. corallina* (= *P. mascula*) sensu Huth (1891), under which were included *P. daurica* Andrews (as *P. corallina* var. *pallasii* Huth), *P. broteri* Boiss. & Reut., *P. russoi* Biv., *P. cambessedesii* and *P. corsica* Sieber ex Tausch. Huth even treated the latter two taxa as a single variety, *P. corallina* var. *cambessedesii* (Willk.) Huth. As we stated before, the peony in Mt Cagna, Corsica, the type locality of *P. corsica*, is extremely polymorphic, with some individuals similar to *P. cambessedesii* in some aspects (carpels and leaves glabrous). However, *P. mascula* and *P. cambessedesii*

are two distinct species, differing in the number of carpels and in having indumentum on leaves and carpels. How could *P. cambessedesii*, with entirely glabrous plants, no more than 9 leaflets and mostly 4–6 carpels, be treated as conspecific with *P. mascula*? According to Huth's principle, *P. obovata* and *P. coriacea* should also be treated as conspecific with *P. mascula*, because these two have more similarities than do *P. cambessedesii* and *P. mascula*. The second question relating to Huth's treatment concerns the true identity of *P. corallina*. Huth (1891) failed to give diagnostic characters to define *P. corallina*. He did describe *P. corallina* (including *P. cambessedesii*) as having “*carpella juniora dense tomentosa, matura saepius glabrescentia*” (carpels densely tomentose when young, often glabrescent when mature), whereas *P. obovata* and *P. coriacea* have “*carpella etiam juniora glabra*” (carpels also glabrous when young). Actually, the carpels of *P. cambessedesii* are always glabrous, like those of *P. obovata*, but not “*matura saepius glabrescentia*” (mature carpels often glabrescent); those in *P. coriacea* are glabrous, but very occasionally hairy; whereas those in *P. corsica* range from glabrous even when young to rather densely hairy.

Huth's treatment of the *P. corallina* group as a single species, including *P. cambessedesii*, *P. corsica*, *P. daurica* and *P. broteri*, while separating it from *P. obovata* and *P. coriacea*, is unjustifiable both biologically and logically. It was followed only by Gürke (1903) and Fiori (1898). Gürke totally adopted Huth's concept, recognising only six species for *Plantae Europaeae*.

Once illogical lumping begins, it is hard to stop. Fiori's (1898) *P. officinalis* in Italy includes *P. officinalis*, *P. peregrina*, *P. paradoxa* (= *P. officinalis* subsp. *huthii*), *P. mascula*, *P. triternata* (= *P. daurica*) and *P. corsica*. If these taxa are members of a single species, then the whole genus *Paeonia*, or at least the whole section *Paeonia*, is a single species.

Another difficulty of species delimitation in *Paeonia* is the wide range of variation of certain characters, e.g. the number of carpels, their indumentum and the colour of petals. A number of taxa have been described on the basis of seemingly distinct forms: *P. lutea*, *P. lagodechiana*, *P. trollioides*, *P. japonica*, *P. oxypetala*, *P. lactiflora* var. *trichocarpa* and *P. veitchii* var. *uniflora*. To avoid this trap, it is essential to adopt the population concept and to analyse characters based on field observations, population sampling, examination of as many herbarium specimens as possible, and subsequent statistical analysis, as explained in the next chapter.

The combined result of the problems in species identity and species delimitation has led to a serious species problem in the taxonomic history of *Paeonia*. This becomes clear when we look at Table 2.2.

The latest work on the genus *Paeonia* is Halda's (2004) monograph, in which 25 species are recognised. Of these 25 species, 19 stand in the present work, while the other five — *P. mlkosewitschii*, *P. potaninii*, *P. rhodia*, *P. veitchii* and *P. wittmanniana* — are reduced as synonyms or as infraspecific taxa (Hong & Zhou, 2003; Hong *et al.*, 1998a, 2001a; Tzanoudakis, 1977). On the other hand, however, ten distinct species are treated by Halda as synonyms or as infraspecific taxa: *P. arietina*, *P. californica*, *P. cambessedesii*, *P. jishanensis*, *P. kesrouanensis*, *P. ludlowii*, *P. ostii*, *P. qiui*, *P. rockii* and *P. sterniana*. *Paeonia intermedia* was still confused with *P. hybrida* by Halda, and *P. algeriensis* might be not clear for him. Therefore, readers will readily find that the list of species in the present work is substantially different from that in Halda (2004).

TABLE 2.2

The number of species recognised in previous monographs and revisions, and the number of species basically consistent in identity and circumscription with those recognised in the present work.

Authors	Number of species enumerated	Number of species basically consistent in identity and circumscription with those in the present work	Species basically consistent in identity and circumscription with those in the present work
de Candolle (1818)	13	3	<i>P. anomala</i> , <i>P. daurica</i> and <i>P. tenuifolia</i>
de Candolle (1824)	16	3	<i>P. anomala</i> , <i>P. arietina</i> and <i>P. tenuifolia</i>
Anderson (1818)	13	4	<i>P. anomala</i> , <i>P. arietina</i> , <i>P. daurica</i> and <i>P. tenuifolia</i>
Seringe (1849)	24	9	<i>P. anomala</i> , <i>P. arietina</i> , <i>P. brownii</i> , <i>P. californica</i> , <i>P. coriacea</i> , <i>P. corsica</i> , <i>P. emodi</i> , <i>P. intermedia</i> and <i>P. tenuifolia</i>
Baker (1884)	22	2	<i>P. emodi</i> and <i>P. obovata</i>
Lynch (1890)	25	5	<i>P. anomala</i> , <i>P. broteri</i> , <i>P. arietina</i> , <i>P. tenuifolia</i> and <i>P. emodi</i>
Huth (1891)	14	4	<i>P. obovata</i> , <i>P. tenuifolia</i> , <i>P. brownii</i> and <i>P. californica</i>
Schipczinsky (1921)	21	8	<i>P. obovata</i> , <i>P. coriacea</i> , <i>P. brownii</i> , <i>P. californica</i> , <i>P. tenuifolia</i> , <i>P. emodi</i> , <i>P. delavayi</i> and <i>P. anomala</i>
Stern (1946)	33	16	<i>P. brownii</i> , <i>P. californica</i> , <i>P. cambessedesii</i> , <i>P. mascula</i> , <i>P. daurica</i> , <i>P. kesrouanensis</i> , <i>P. obovata</i> , <i>P. mairei</i> , <i>P. arietina</i> , <i>P. broteri</i> , <i>P. coriacea</i> , <i>P. lactiflora</i> , <i>P. emodi</i> , <i>P. peregrina</i> , <i>P. officinalis</i> and <i>P. clusii</i>
Halda (2004)	25	11	<i>P. officinalis</i> , <i>P. peregrina</i> , <i>P. parnassica</i> , <i>P. coriacea</i> , <i>P. broteri</i> , <i>P. obovata</i> , <i>P. mairei</i> , <i>P. tenuifolia</i> , <i>P. lactiflora</i> , <i>P. decomposita</i> and <i>P. corsica</i>

3. CHARACTERS AND THEIR VARIATIONS

3.1 HABIT

The genus *Paeonia* contains plants of two types: shrubs and perennials. The shrubs, called tree peonies, form a natural group, sect. *Moutan* DC., and are all endemic to China (Map 4.2). The perennials, called herbaceous peonies, fall into two groups, one in the New World (western N America), sect. *Onaepia* Lindl. (Map 4.3), and the other in the Old World (temperate Eurasia and NW Africa), sect. *Paeonia* (Map 4.4).

3.2 ROOTS

The roots of most shrubby species are not special, and resemble those of most shrubs in other groups. *Paeonia delavayi* is exceptional, however, with its roots fusiform-thickened (Fig. 3.1d).

In the American group (sect. *Onaepia* Lindl.), the roots of both species are slightly fusiform-thickened (Fig. 3.1c).

In the Old World perennials (sect. *Paeonia*), the roots are thickened and either carrot-shaped or tuberous (Fig. 3.1a,b,e,f). Carrot-shaped or tuberous roots are characteristic of species in sect. *Paeonia*, and their variation is closely correlated with that of some other characters. The shape of tubers varies in *P. intermedia* (Fig. 3.2), but they are still all tubers.

Miller (1768) noted root shape when he described *P. lusitanica* Mill. (= *P. broteri* Boiss. & Reut., nom. cons.) as new, stating that the root of this plant was “not composed of roundish tubers or knobs, but hath two or three long, taper, forked fangs like fingers” (see Fig. 5.18A). Nearly all later authors neglected roots and we can hardly find a herbarium specimen that has them. For this reason, some species have been treated unreasonably. For example, in reducing *P. arietina* G. Anderson to a subspecies of *P. mascula*, Cullen and Heywood (1964a) neglected the roots and their correlated characters. *Paeonia arietina* has tuberous roots that are associated with densely villose stems, petioles and sepals, whereas *P. mascula* has carrot-shaped roots that are associated with stems, petioles and sepals that are always glabrous. *Paeonia arietina* has been shown to be distinct from *P. mascula* (Hong *et al.*, 2008). Furthermore, molecular trees based on sequences of cpDNA *matK* and internal transcribed spacers (ITS) of nrDNA show that the closest relative of *P. arietina* is not *P. mascula* but the *P. officinalis* L. group (Sang *et al.*, 1995, 1997a).

Because the character of roots in *P. anomala* L. and *P. intermedia* C. A. Mey. was not clear to the relevant authors, *P. intermedia* has been variously treated, mostly as an infraspecific taxa of *P. anomala* or *P. hybrida*. Actually, *P. intermedia* clearly differs from *P. anomala* in shape of roots (tuberous versus carrot-shaped) and in sepals (mostly rounded versus mostly caudate at the apex). These two characters are well correlated, which is useful in identifying specimens without roots. The two species are also ecologically differentiated, with *P. anomala* usually growing in forests, whereas *P. intermedia* is mostly found on shrubby or grassy slopes (Hong & Pan, 2004).



Fig. 3.1. Roots of the genus *Paeonia* L.: **a**, carrot-shaped roots in *P. lactiflora*; **b**, carrot-shaped roots in *P. kesrouanensis*; **c**, slightly fusiform roots in *P. californica*; **d**, fusiform roots in *P. delavayi*; **e**, fusiform roots in *P. saueri*; **f**, tuberous roots in *P. intermedia*.

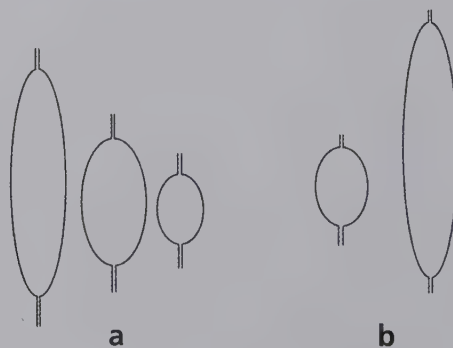


Fig. 3.2. Variation of root shape in *P. intermedia* C. A. Mey.: **a**, different-shaped roots on the same individual, Li & Zhu 10414 (PE) from Huocheng, Xinjiang, China; **b**, Y. R. Ling 74848 (PE), left, and Y. R. Ling 74849 (PE), right.

3.3 CAUDEX

A caudex is present in herbaceous peonies (sect. *Onaepia* and sect. *Paeonia*). This is an underground part of the stem that connects the annual aerial stems to the roots. A caudex becomes sympodial and branched when it is several years old (Fig. 3.3). Usually, two to several shoots (aerial and annual stems) come from one caudex, and thus aerial stems are caespitose. The caudex elongates gradually with age, but it is generally no more than 15 cm long. The only exception was found in *Paeonia cambessedesii* (Willk.) Willk. A collection of this species (G. E. Martindale 146 (K) from Mallorca) has a caudex of 17 cm (Fig. 3.3), which may be called a rhizome. No taxonomists have paid attention to the caudex of *Paeonia*, although this plant part reflects a plant's biology to some extent. We often found *P. obovata* and *P. mairei* plants with single stems, whereas the stems of *P. sterniana* and *P. anomala* form a large clump. Thus, there are major or minor differences between species in the branching of the caudex.

3.4 STEMS

In tree peonies (sect. *Moutan*), the stems are lignified. A shoot comes from a lateral scaled bud, and thus stems are always sympodial. The tallest stems rise to 3.5 m in *Paeonia ludlowii* (Stern & G. Taylor) D. Y. Hong. A great variation in the height of stems was observed in *P. delavayi*, from 20 cm tall in the population H97095 (Lijiang County, Yunnan) to c. 2 m tall in H97103 (also Lijiang).

Stems are nearly always simple in herbaceous peonies, but occasionally we found a branch coming from the axil of an upper scale, e.g. *A. Boros s.n.* (BP) from the Mescek Mountains, Hungary (*P. officinalis* subsp. *banatica*) and D. Y. Hong *et al.* H02204 (A, BM, K, MO, PE, UPA) from Mt Ida, Turkey (*P. arietina*). Both fertile and sterile examples of such branches were found.

Stems are usually green or green and purple, or occasionally entirely purple.

Until now, no taxonomists have used height as a diagnostic character for taxonomy in *Paeonia*, and our studies tell us that height is too variable to be useful.

3.5 SCALES

As buds are always enveloped by scales, which are usually persistent, scales are nearly always present at the base of both the shoots of tree peonies and the aerial stems of herbaceous peonies. They may be yellow, pink or even purple. The number of scales is mostly five or six, but varies greatly even within populations. For example, it ranges from five to nine in D. Y. Hong *et al.* H01015 from Corsica (*Paeonia corsica* Sieber ex Tausch), and from four to eight in D. Y. Hong *et al.* H02207 from Turkey (*P. kesrouanensis*). Scales have not been found to be valuable in determining the taxonomy of *Paeonia*.

3.6 LEAVES

Leaves in *Paeonia* are consistently compound. In *Paeonia*, unlike most other plant groups, both leaf size and the number of leaflets change greatly on a stem from the base upwards (Fig. 3.4). Therefore, the character of leaves can not be precisely described without mentioning their position on a stem. It is impossible to distinguish two species using number of leaflets or leaf segments if we do not know whether they are from the same position.

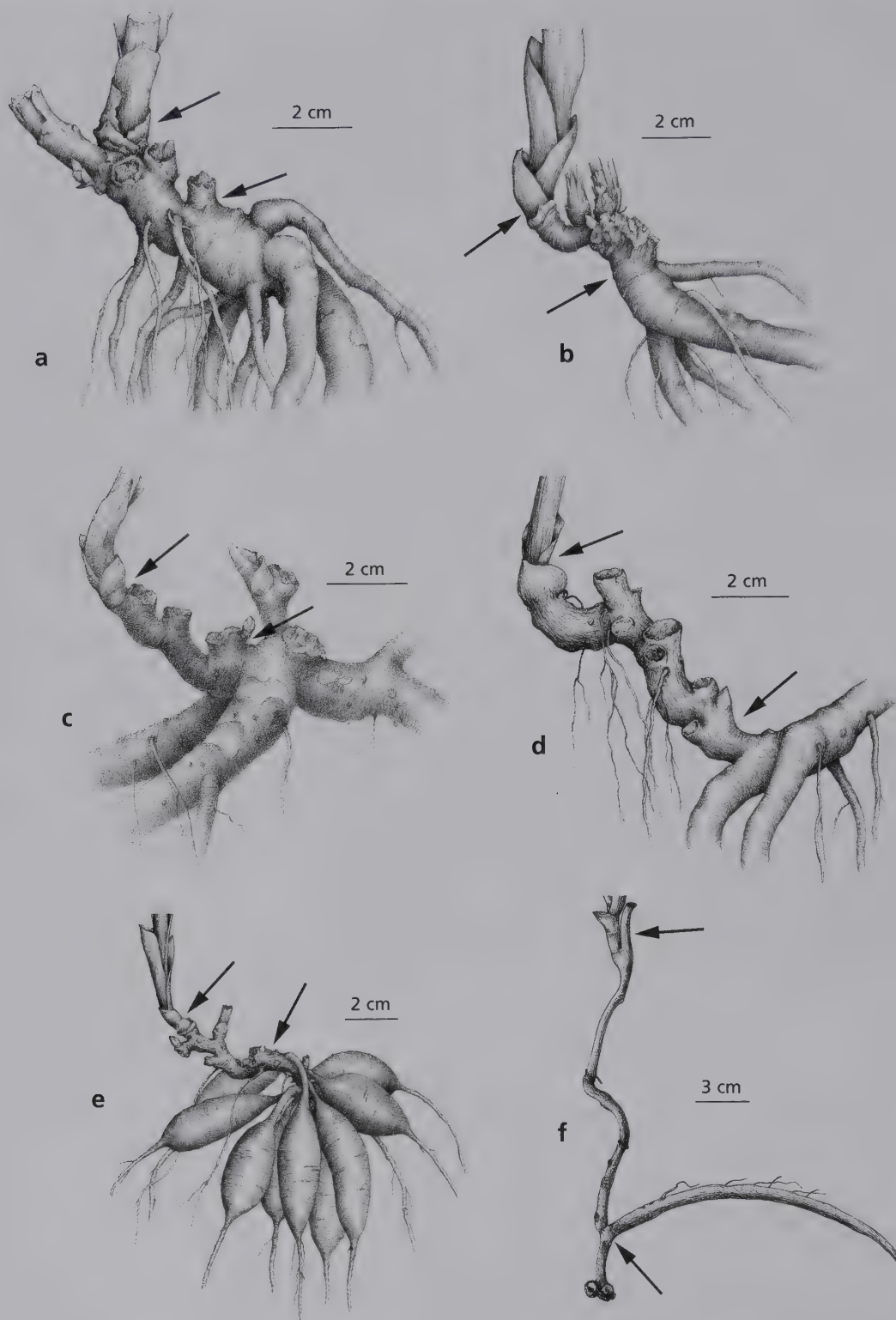


Fig. 3.3. The variation of caudex (between the two arrows) in the genus *Paeonia*. **a**, *P. lactiflora*; **b**, *P. sterniana*; **c**, *P. daurica* subsp. *daurica*; **d**, *P. mairei*; **e**, *P. tenuifolia*; **f**, *P. cambessedesii*.

The lowermost one or two leaves are the best developed and have the most leaflets. We have found nine patterns of compound leaves in *Paeonia*: ternate, biternate, triternate, ternate-pinnate, biternate-pinnate, triternate-pinnate, ternate-bipinnate, biternate-bipinnate or rarely quartiternate-pinnate. Ternate-pinnate and ternate-bipinnate leaves are found in *P. delavayi* (Fig. 5.2A), *P. rockii* (Fig. 5.4A) and *P. ostii* (Fig. 5.5A); triternate leaves are characteristic of *P. tenuifolia* (Fig. 5.27A); ternate leaves occur only in *P. californica* (Fig. 5.10A), and biternate-bipinnate, triternate-pinnate or quartiternate-pinnate leaves are found only in *P. decomposita* (Fig. 5.3A).

'Biternate-bipinnate' and 'quartiternate-pinnate' are newly discovered patterns of compound leaves in seed plants, and these two words are created here especially to describe these patterns. All the other species of *Paeonia* have biternate lower leaves. The pattern of the lower leaves is stable and is characteristic of *Paeonia* species. These nine patterns of lower leaves are recognised in *Paeonia* here for the first time.

Whether leaflets are entire or segmented is rather stable, and thus valuable for the taxonomy of *Paeonia*. For example, the lower leaves of *P. obovata* and *P. cambessedesii* are always biternate, and all the leaflets of these species are entire, never segmented. The number of leaf segments varies within a certain range within species but varies greatly from species to species.

Some taxonomists have used leaf characters for the taxonomy of *Paeonia*. Stern (1946) divided Eurasian herbaceous peonies (sect. *Paeonia*) into two subsections according to the number of leaf segments. Leaf characters have not, however, been fully used for the taxonomy of *Paeonia*. For example, the tree peonies in central China were treated as a single species, *P. suffruticosa* Andrews, before the 1990s (Haw & Lauener 1990, Pan 1979, Stern 1946). Hong and Pan (1999a, 2007) revised the taxonomy of this group, recognising five wild species and cultivated *P. suffruticosa*. The five wild species can be distinguished clearly by the pattern of their lower leaves (Fig. 3.5). In another example, *P. daurica* and *P. corsica* have been confused with *P. mascula*, but the lower leaves of *P. mascula* usually have 11–18 leaflets or leaf segments, whereas the other two species nearly always have nine leaflets. In correlation with this character state, *P. corsica* differs from *P.*



Fig. 3.4. All five leaves on a stem from below (left) to above (right) in *Paeonia saueri* D. Y Hong, X. Q. Wang & D. M. Zhang (Hong *et al.* H02227 from Greece).

mascula in having shorter hairs on its carpels (1.5 mm in the former versus 3 mm in the latter), in having rather densely villose leaves (rather than mostly glabrous or sparsely hispid in *P. mascula*), and in being diploid. *Paeonia daurica* differs from *P. mascula* in having a rounded or truncate leaf apex (rather than the acute apex in *P. mascula*), and in being diploid with isolated tetraploid populations in alpine areas in the Caucasus and in the Talish and Elburz Mountains of Azerbaijan and Iran.



Fig. 3.5. Different patterns of lower leaves of five wild species in the *Paeonia suffruticosa* group of sect. *Moutan*: **a**, *P. cathayana*; **b**, *P. jishanensis*; **c**, *P. qiui*; **d**, *P. ostii*; **e**, *P. rockii*; **e₁**, subsp. *rockii*; **e₂**, subsp. *atava*.

3.7 INDUMENTUM

The type of indumentum is more stable than its density. As indumentum varies in different parts of individual plants, it is described separately for each plant part.

3.7.1 INDUMENTUM ON STEMS

Stems are totally glabrous in most peony species. Hirsute stems are characteristic of *Paeonia arietina*, *P. parnassica*, *P. officinalis* subsp. *officinalis* and *P. officinalis* subsp. *huthii*.

3.7.2 INDUMENTUM ON PETIOLES

Petioles are glabrous in most species, but hairy in *Paeonia arietina*, *P. parnassica*, *P. officinalis* and *P. algeriensis*. The hairs on the petioles are of the same type as those on the stems.

3.7.3 INDUMENTUM ON LEAVES

Leaves are glabrous on the upper surface in most peony species, but bristles (Fig. 3.6c) are found more or less frequently along veins in *Paeonia peregrina*, *P. tenuifolia*, *P. saueri*, *P. anomala*, *P. intermedia*, *P. lactiflora* and *P. emodi*.

The lower surface of leaves is more frequently hairy. To date, four types of hairs have been found on the lower surface: 1) villose hairs (Fig. 3.6d) are the most common and occur in *P. arietina*, *P. officinalis*, *P. parnassica*, *P. daurica* subsp. *tomentosa* and subsp. *velebitensis*, and in *P. corsica*; 2) puberulous hairs (Fig. 3.6e), which are short but curved or twisted, are found only in *P. daurica* subsp. *mlokosewitschii*; 3) hispid hairs (Fig. 3.6a), which are long but nearly straight, are found only in *P. mascula*; and 4) hispidulous hairs (Fig. 3.6b), which are short and straight, are found only in *P. saueri*.

Indumentum on leaves is an important character for the taxonomy of *Paeonia*, and has been used frequently. A number of taxa were named for the indumentum on their leaves: for example, *P. tomentosa* Lomakin (= *P. daurica* subsp. *tomentosa* (Lomakin) D. Y. Hong) and *P. villosa* (a synonym of *P. officinalis* subsp. *huthii*). On the other hand, many *Paeonia* species have entirely glabrous leaves, e.g. *P. cambessedesii*, *P. broteri*, *P. clusii*, *P. ludlowii*, *P. delavayi* and *P. sterniana*. This character should, however, be used with caution. Puberulous hairs are found only in *P. daurica* subsp. *mlokosewitschii*, and it seems that this type of hairs can be used to distinguish this subspecies from other groups. But even at the type locality of this taxon, Lagodekhi, Georgia (Hong & Zhou H99035), a high ratio of individuals are glabrous on the lower leaf surface. Indumentum on leaves is characteristic of certain species but it is also variable from sparse (even glabrous) to dense. One way to use indumentum would be to divide it into (say) six grades and then to analyse its presence quantitatively (Hong *et al.*, 2001c, 2004a).

3.7.4 INDUMENTUM ON SEPALs

Sepals are hairy on the abaxial surface only in *Paeonia arietina*, *P. parnassica*, *P. officinalis* and *P. daurica* subsp. *velebitensis* D. Y. Hong. Two types of hairs could be distinguished: villose and hispidulous (Fig. 3.7). Sepals are always villose in *P. arietina* and *P. parnassica* and in *P. daurica* subsp. *velebitensis*, which has been found only in the Velebit Mountains, Croatia (Fig. 3.7a). Hispidulous hairs occur in *P. officinalis*, which is diverse in morphology and comprises five subspecies. Two of these subspecies, subsp. *officinalis* and subsp. *huthii*, are constantly hispidulous on the sepals; in subsp. *banatica*, the sepals may be glabrous to densely hispidulous (Fig. 3.7b); but in subsp. *microcarpa*, the sepals are nearly always glabrous.

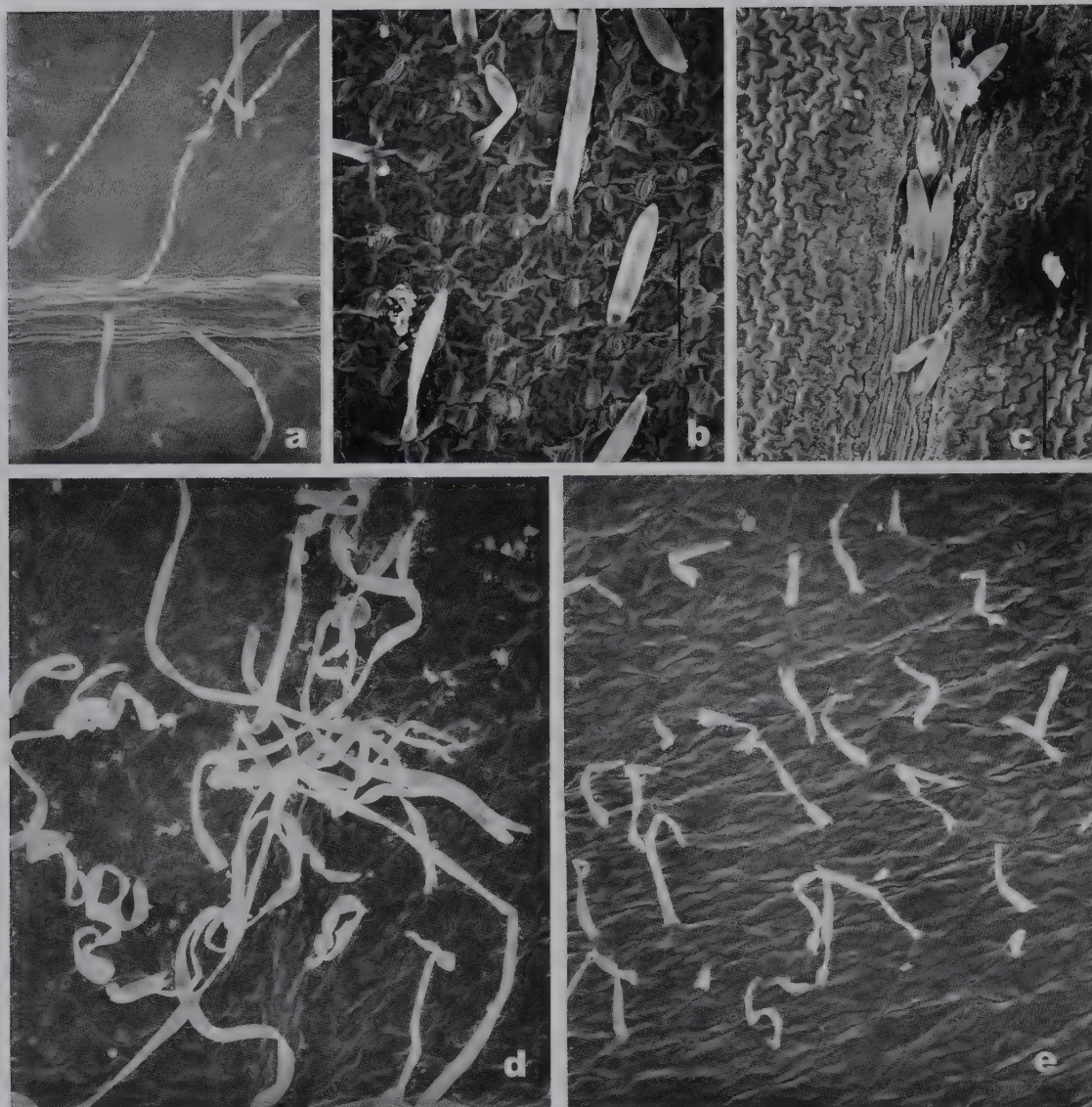


Fig. 3.6. Hairs on leaves of *Paeonia*. **a**, hispid on the lower surface in *P. mascula* subsp. *mascula* (H01020 from Italy); **b**, hispidulous on the lower surface in *P. saueri* (H02227 from Greece); **c**, bristles along veins on the upper surface in *P. saueri* (H02227); **d**, villose on the lower surface in *P. corsica* (H01014 from Corsica); **e**, puberulous on the lower surface in *P. daurica* subsp. *mlokosewitschii* (H99035 from Georgia).

3.7.5 INDUMENTUM ON CARPELS

This character has been emphasised even since the early period of *Paeonia* taxonomy. A number of taxa were named according to the state of this character: *P. leiocarpa* Rouy & Foucaud (1893), *P. leiocarpa* Jord. (1903), *P. wittmanniana* var. *nudicarpa* Schipcz. and *P. albiflora* (= *P. lactiflora*) var. *trichocarpa* Bunge.

There are four types of indumentum on carpels:

1) Lanate hairs (Fig. 3.8a,c), which are 2.5–3 mm long and entirely cover the surface of the carpels. This type is found in *Paeonia qiui* and *P. ostii* in sect. *Moutan*, and in *P. mascula*, *P. daurica* and *P. broteri* in sect. *Paeonia*.

2) Tomentose hairs (Fig. 3.8b,d), which are short and entirely cover the ovaries. This type is found in most peony species.

3) Hispidulous hairs (Fig. 3.8e₁), which are 1.5 mm long, straight or nearly straight, and often do not entirely cover the carpels. They are found in *Paeonia corsica*, *P. mairei* (partial), *P. lactiflora* (if the carpels are hairy) and *P. coriacea* (very occasionally hairy).

4) Papillose hairs (Fig. 3.8e₂), found only in *Paeonia mairei* (which sometimes has glabrous carpels).

The type of hairs on the carpels is stable within a species and is characteristic of individual species. The presence or absence and the density of hairs on carpels are also valuable characters for *Paeonia* taxonomy, although they are less consistent than the type of hairs.

The carpels are consistently lanate in *Paeonia mascula*, *P. broteri* and *P. clusii* of sect. *Paeonia*, and in *P. ostii* and *P. qiui* of sect. *Moutan*. They are tomentose in *P. arietina*, *P. parnassica*, *P. saueri*, *P. peregrina* and *P. tenuifolia* of sect. *Paeonia*, and in *P. rockii* and *P. jishanensis* of sect. *Moutan*. On the other hand, a number of species constantly have entirely glabrous carpels: *P. cambessedesii*, *P. kesrouanensis* and *P. obovata* in sect. *Paeonia*; *P. ludlowii*, *P. delavayi* and *P. decomposita* in sect. *Moutan*, and *P. brownii* and *P. californica* in sect. *Onaepia*. However, indumentum on the carpels is variable in other species and is characteristic of some subspecies. For example, in the *P. officinalis* group, nearly all populations in Spain and SW France (near the Pyrenees) possess glabrous carpels, but eastwards the situation is different. Individuals with tomentose carpels and those with glabrous carpels coexist at Pic St. Loup, Montpellier, S France. Further east, all populations consistently have tomentose carpels. Therefore, the character of indumentum on carpels may only be used for distinguishing the subspecies. Even within the distribution range of *P. officinalis* subsp. *microcarpa* (Spain and SW France), a few individuals with hairy carpels are found.

At the other extreme, indumentum on the carpels is just a polymorphic phenomenon. *Paeonia lactiflora* var. *trichocarpa* (Bunge) Stern (= *P. albiflora* var. *trichocarpa* Bunge) was first described on the basis of a specimen with hairy carpels. During our expedition to Inner Mongolia in 2004, we found a large number of individuals with glabrous carpels growing together with a few individuals that

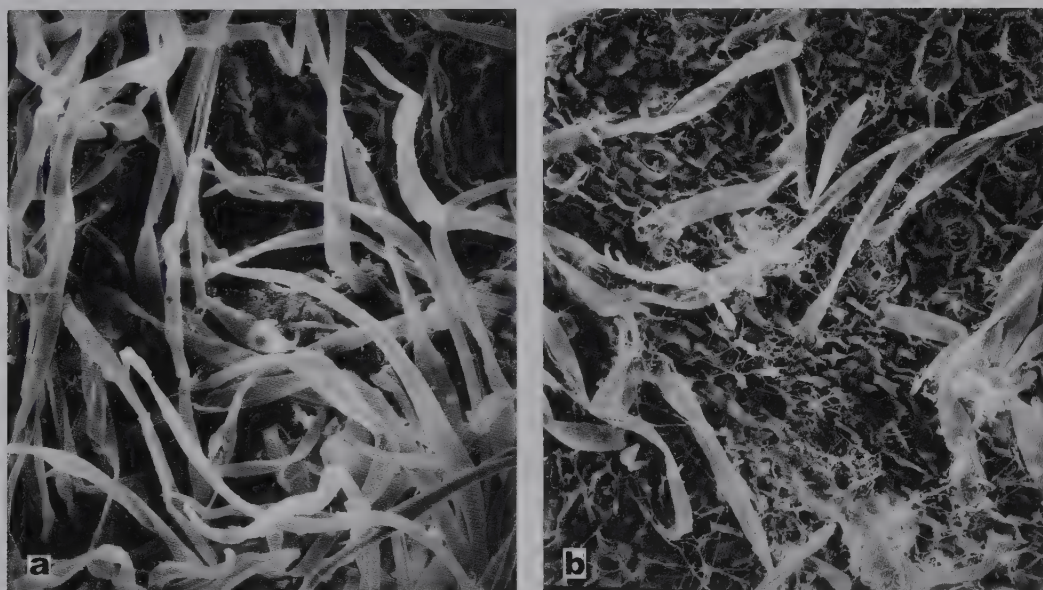


Fig. 3.7. Hairs on the abaxial side of sepals in *Paeonia*: **a**, villose in *P. arietina* (H02204 from Mt. Ida, Turkey; **b**, hispidulous in *P. officinalis* subsp. *banatica* (H03020 from Banat, Serbia).

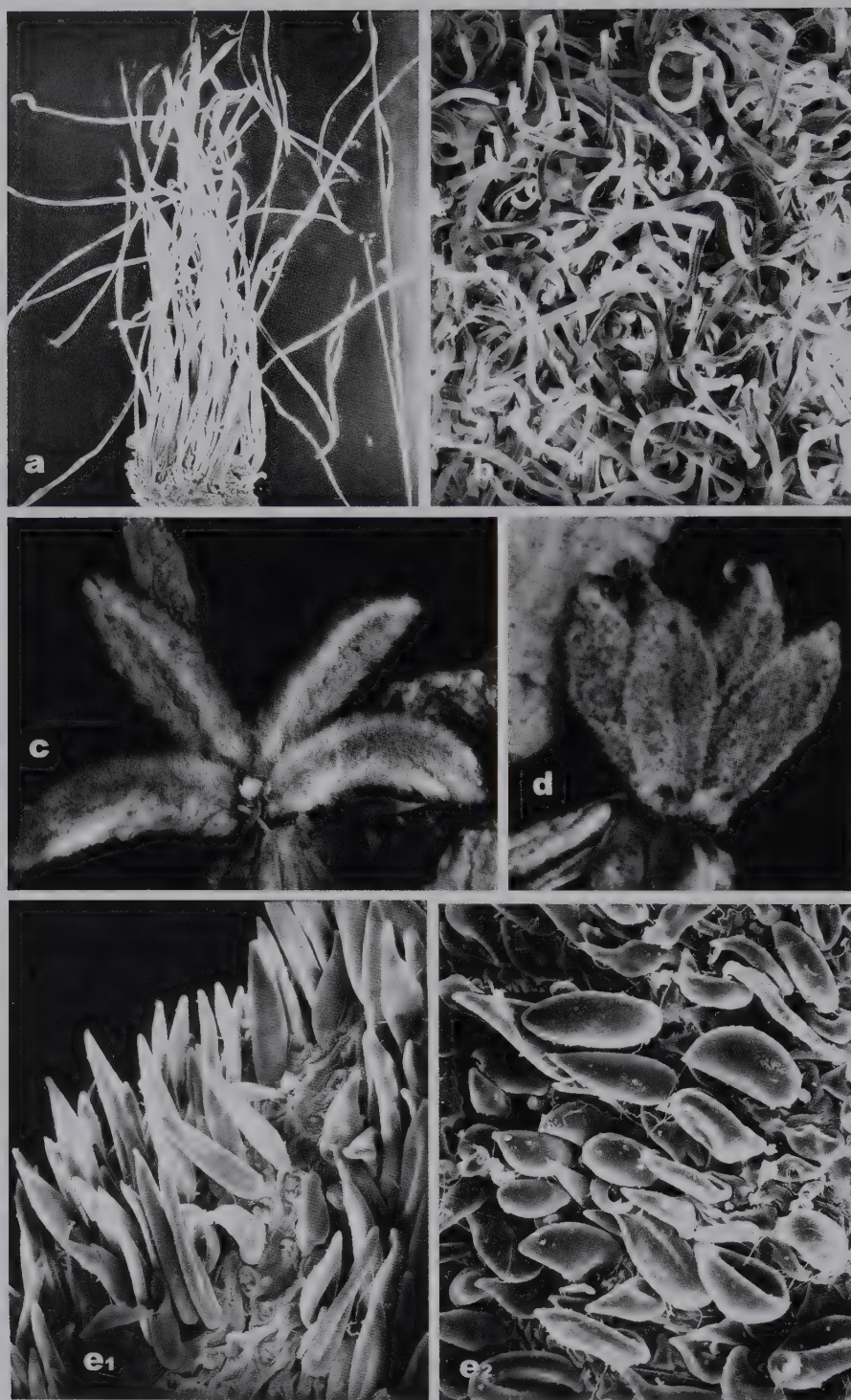


Fig. 3.8. Hairs on carpels of *Paeonia*: **a**, lanate in *P. mascula* subsp. *mascula* (H01004 from France); **b**, tomentose in *P. corsica* (H01014 from Corsica); **c**, lanate in *P. mascula* subsp. *russoi* (H01020 from Sicily); **d**, tomentose in *P. corsica* (H01018 from Sardinia); **e**₁, hispidulous in *P. mairei* (Z. He 12388 from Lixian, Sichuan); **e**₂, papillose in *P. mairei* (PB85023 from Wolong, Sichuan) (all vouchers in PE).

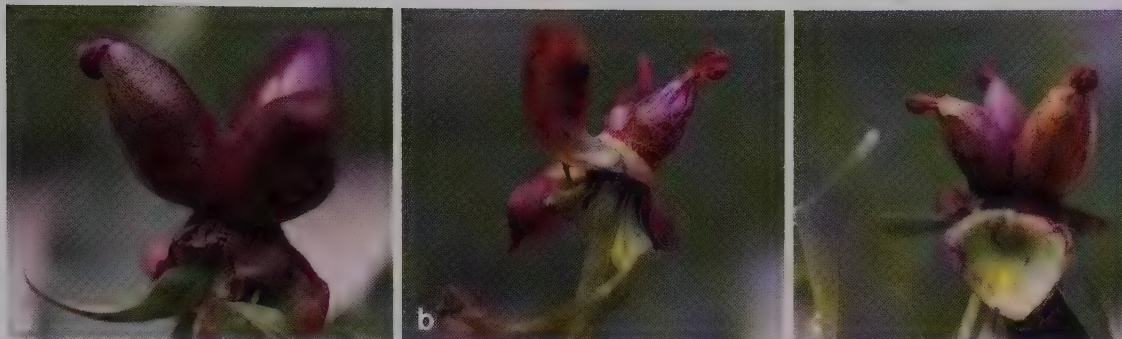


Fig. 3.9. Polymorphism in indumentum on carpels in *P. lactiflora* in the population Hong *et al.* H04040 (Mt Huanggangliang, Inner Mongolia); **a**, glabrous; **b**, very sparsely hairy; **c**, rather densely hairy.

had hairy carpels (D. Y. Hong *et al.* H04040) in the foothills of Mt Huanggangliang (Fig. 3.9). The density of hairs on the carpels varied from a few hairs to moderately dense. Apparently, *P. lactiflora* var. *trichocarpa* should be reduced to a synonym.

Similarly, in Lixian County, Sichuan, we found plants of *Paeonia anomala* subsp. *veitchii* (= *P. veitchii*) with either hairy or glabrous carpels growing together (D. Y. Hong *et al.* H95034) (Fig. 3.10). Therefore, *P. veitchii* var. *woodwardii* (Stapf ex Cox) Stern (described based on a specimen with hairy carpels) had to be reduced to a synonym of *P. anomala* subsp. *veitchii*.

Peonies from Corsica and Sardinia have been variously treated and have up to 30 synonyms. One cause of the confusion was how taxonomists treated the character of glabrous carpels. Our expedition to Corsica and Sardinia found that individuals with glabrous and hairy carpels coexisted on Mt Cagna, S Corsica (D. Y. Hong *et al.* H01015). This polymorphism also occurred on Mt Limbardo, N Sardinia, where *Reverchon* 291 was collected. Among 10 individuals on eight duplicates of *Reverchon* 291 (E, K, P and WU), three have glabrous carpels, six have tomentose carpels and one has very sparsely hairy carpels. Clearly, all individuals from Corsica and Sardinia, no matter whether they have hairy or glabrous carpels, belong to the same species, *Paeonia corsica* Sieber ex Tausch (Hong & Wang, 2006).

3.7.6 INDUMENTUM: COLOUR

Hairs are usually white on stems, petioles, leaves and sepals, but variable in colour on carpels. Hairs on carpels are generally brownish-yellow or yellowish-white, but in *Paeonia tenuifolia*, the indumentum may be green, yellow or totally purple (Fig. 3.11).

3.8 BRACTS-SEPALS SERIES

The genus *Paeonia* is one of the few angiosperms genera in which bracts and sepals are not distinct, i.e. bracts grade into sepals. In *Paeonia*, it is easy to find a series from leaves to sepals, or even to petals via leafy (involucrate) bracts (Figs 5.28B, 5.29C and 5.30B), and different series can be found among *Paeonia* species. For convenience, an element in this series whose lower part is wider than the upper part is defined as a sepal, otherwise it is called a bract. In tree peonies (sect. *Moutan*), the series is gradual and continuous, and thus no typical sepals can be found (Fig. 3.12a,b) except in *P. jishanensis* (Fig. 5.6B). A similar situation is found in some Asian species of sect. *Paeonia*, i.e. *P. anomala*, *P. lactiflora*, *P. emodi* and *P. sterniana* (Fig. 3.12c), and less typically in the two American species, *P. brownii* and *P. californica* (Fig. 3.12d). For all these species, the sepals are mostly caudate



Fig. 3.10. Polymorphism in indumentum on follicles in *P. anomala* subsp. *veitchii* in the population Hong *et al.* H95034 (Lixian, Sichuan Province): **a**, glabrous; **b**, sparsely hairy.



Fig. 3.11. Variation in colour of indumentum on carpels and of filaments within and between populations in *P. tenuifolia*: **a**, Hong & Zhou H99028 from Igoeti, Georgia; **b–d**, Hong & Zhou H99043 from Mukhrani, Georgia.

at the apex. For all other species, i.e. most species in sect. *Paeonia*, the gradation is more or less interrupted. The sepals are mostly non-caudate and thus more or less distinct from bracts, though inconsistent in shape and size (Fig. 3.12e,f).

The bracts-sepals series is of certain taxonomic value. Because of their similar leaflets (or leaf segments), *Paeonia intermedia* and *P. anomala* had long been confused before Hong and Pan (2004) found that *P. intermedia* has most of its sepals rounded at the apex (Fig. 5.26B), whereas *P. anomala* has all or most of its sepals caudate at the apex (Fig. 5.14B). This character is closely correlated with root shape (Figs 5.14A, 5.26A). Using these two characters, the two species are readily distinguished.

The bracts-sepals series also reflects the systematic position of a taxon within *Paeonia*; in general, a gradual gradation of the bracts-sepals series with most or all of the sepals caudate at the apex is correlated with primitive characters, such as woody habit, multi-flowered stems (shoots) and diploidy.

3.9 NUMBER OF FLOWERS PER SHOOT

This character is described relatively easily. In sect. *Moutan*, the shoots of *Paeonia ludlowii* and *P. delavayi* are constantly multi-flowered, whereas flowers in the other six species are solitary and terminal. In section *Onaepia*, the two species, *P. brownii* and *P. californica*, are both multi-flowered, though the flowers often look solitary and terminal. One or two undeveloped (sterile) flower buds can often be found in the axils of the upper leaves. For these two sections, there is no taxonomic problem caused by misunderstanding of this character.

In sect. *Paeonia*, however, all the species except those mentioned below consistently have solitary flowers. *Paeonia lactiflora* and *P. emodi* are both described as multi-flowered and cause no taxonomic problems. Problems occur only in the *P. anomala*–*P. veitchii* group. *Paeonia anomala* was described as single-flowered (Schipczinsky, 1937; Pan, 1979), whereas *P. veitchii* was described as multi-flowered (Lynch, 1909; Pan, 1979). The demarcation between these two species was made on the basis of this single character. It is true that *P. veitchii* (= *P. anomala* subsp. *veitchii*) often has multi-flowered stems, but single-flowered stems with one or two undeveloped flower buds in axils of the upper leaves are also often found, and single-flowered stems occur very rarely without any additional undeveloped flower buds. Such individuals have been described as a variety, *P. veitchii* var. *uniflora* K. Y. Pan (1979). In *P. anomala* (= *P. anomala* subsp. *anomala*), flowers are nearly always solitary, but, besides the terminal flower, one or two undeveloped flower buds can sometimes be found in axils of the upper leaves, and very occasionally there are two flowers on a stem. *Paeonia altaica* K. M. Dai & T. H. Ying (1990) was based on such an individual. In our observation of specimens from the site in the Altai (Wuzkiliti, Habahe County) where the type was collected, three kinds of individuals coexisted: single-flowered without any additional undeveloped flower bud, single-flowered with one or two undeveloped flower buds, and two-flowered. Plainly, the character of flower number varies in the *P. anomala*–*P. veitchii* group. We therefore treated the group as a single species with two subspecies isolated by the Gobi.

3.10 PETALS

3.10.1 PETAL COLOUR

This character has been frequently used in the taxonomy of *Paeonia*. Many taxa were described on the basis of petal colour, e.g. *P. lutea*, *P. delavayi* var. *atropurpurea*, *P. delavayi* var. *alba* and *P. japonica* (which is white whereas *P. obovata* is pink). An extreme case is *Kemularia*–Nathadze's

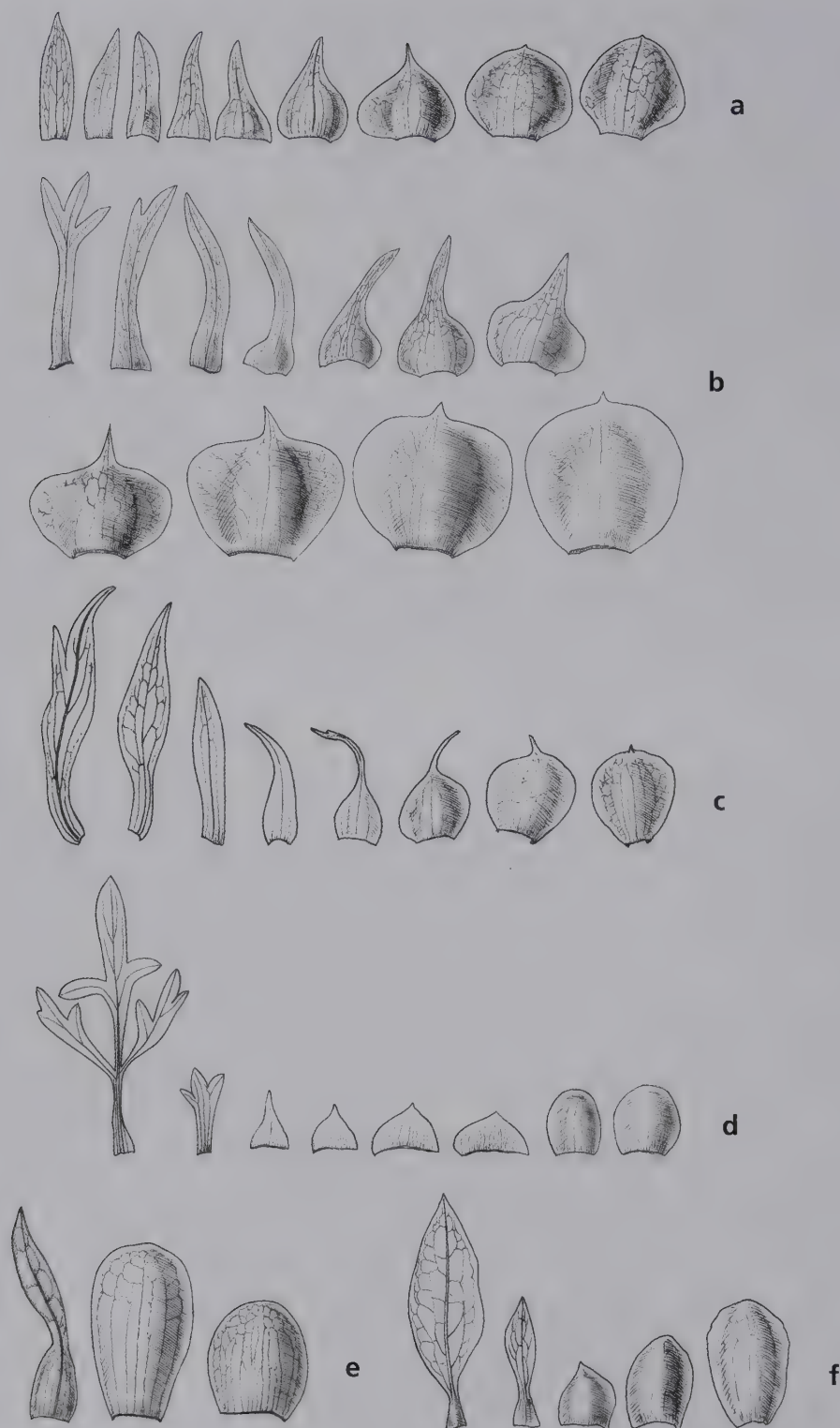


Fig. 3.12. Involucrate bracts and sepals in *Paeonia*. **a**, *P. ludlowii* H96005; **b**, *P. rockii* H04042; **c**, *P. sterniana* H03002; **d**, *P. brownii* 7701; **e**, *P. obovata* subsp. *willmottiae* H04044; **f**, *P. cambessedesii* H01002.



Fig. 3.13. Polymorphism in colour of petals: **a**, the population Hong *et al.* H97112 (Zhongdian, Yunnan) in *P. delavayi*; **b**, the population Hong & Zhou H99035 (Lagodekhi, Georgia) in *P. daurica* subsp. *mlkosewitschii*.

establishment of a section solely on the basis of yellow petals, into which she placed both herbaceous and tree peonies.

Petal colour can be used for taxonomy in *Paeonia*, but cautiously. In some cases, petal colour is characteristic of certain species. The petals of most peony species are red or pink, but they are consistently white in *P. clusii* and *P. emodi*, white but rarely shading to pink at the base or the periphery in *P. ostii* and *P. jishanensis*, and pure yellow in *P. ludlowii*. In further cases, petal colour is more or less geographically differentiated and is useful for infraspecific classification. For example, in the *P. mascula* group, petals are red in most of its range (subsp. *mascula*) but white in Çanakkale Province, NW Turkey (subsp. *bodurii*), c. 90% white on the Aegean islands (subsp. *hellenica*), and mostly white in Sicily and Calabria in Italy (subsp. *russoi*).

In the other cases, however, variation in petal colour is just a polymorphism. A typical petal-colour polymorphism occurs in the *Paeonia delavayi*–*P. lutea* group. In NW Yunnan, we found petal colour varying from white through greenish-yellow, yellow, yellow with red spots, orange-red, pink, red to dark purple. In two populations (D. Y. Hong *et al.* H97112 and D. Y. Hong *et al.* H97128, both from Zhongdian (now Shangri-La) County, Yunnan), the range of petal colours was even greater (Fig. 3.13a). This range covered all the colours described for *P. delavayi*, *P. lutea*, *P. trollioides*, *P. delavayi* var. *atropurpurea* and *P. delavayi* var. *alba*, and so we treated all these taxa as a single entity, *P. delavayi* (Hong *et al.*, 1998a).

At Lagodekhi, Georgia, we found another example of petal-colour polymorphism (Fig. 3.13b). This population (Hong & Zhou H99035) is at the type locality of two species, *Paeonia mlkosewitschii* Lomakin (1897) and *P. lagodechiana* Kem.-Nath. (1961). Therefore, the latter name is superfluous (Hong & Zhou, 2003). The colours used by Kemularia-Nathadze to distinguish different sections of *Paeonia* were just variations within a population. How far her treatment is from nature!

3.10.2 PETAL NUMBER

Petals continue the gradation in *Paeonia*: from leafy bracts to sepals and then petals. The number of petals is not constant within species, however, varying from 4 to 13, and so is not useful in taxonomy. Enormous variation in petal number can frequently be found even within populations. For example, in *P. delavayi*, petals were 4–7 or 10 in number in the population D. Y. Hong *et al.* H97119 (Dêqên, Yunnan); 8, 10, 11 or 13 in D. Y. Hong *et al.* H97087 (Mt Cangshan, Yunnan); and 5–11 in D. Y. Hong *et al.* H97112 (Zhongdian, Yunnan). In *P. daurica*, petal number varied from 5 to 7 in D. Y. Hong *et al.* H02215 from Turkey.

3.11 STAMENS

3.11.1 NUMBER OF STAMENS

Stamens are consistently numerous in *Paeonia*, but the number of stamens has sometimes been used for taxonomy. Ding and Liu (1991) used this character in distinguishing *P. japonica* (white-flowered) from *P. obovata* (red-flowered), saying that the number of stamens was 100–280 in *P. japonica* and 14–75 in *P. obovata*. However, we found that the number ranged from (58)70 to 230 in “*P. japonica*” and from 21 to 110 in “*P. obovata*”. The number of stamens was not a diagnostic character for distinguishing the two colour forms as separate species (Hong *et al.*, 2001c). There is no case in which this character has been successfully used in the taxonomy of *Paeonia*.

3.11.2 COLOUR OF FILAMENTS

Filament colour can vary greatly even within populations. In *Paeonia obovata*, filaments range from white, yellow-green and purple below but white above to entirely purple (Hong *et al.*, 2001c); whereas in *P. tenuifolia*, they may be purple or white (Hong & Zhou, 2003) (Fig. 3.11).

3.11.3 COLOUR OF ANTHERS

Anthers are consistently yellow in the great majority of species in *Paeonia*, but we did find anther colour polymorphism in *P. obovata*. In the population D. Y. Hong *et al.* H98007 from Henan, anthers were yellow, orange-red or dark purple (Hong *et al.*, 2001c). The only case in which anther colour may be valuable in distinguishing related species is in the *P. arietina*–*P. parnassica* group. The anthers are always yellow and well correlated with red petals in *P. arietina* (D. Y. Hong *et al.* H02204 and D. Y. Hong *et al.* H02018 from Turkey), whereas they are consistently orange-red and well correlated with dark-purple petals in *P. parnassica* (D. Y. Hong *et al.* H02224 from Greece).

3.12 DISK: SHAPE, TEXTURE AND COLOUR

The disk is consistently present in *Paeonia*. In sect. *Onaepia*, the disk is interrupted and dentate, whereas in the other two sections, it is entire or nearly entire. In sect. *Moutan*, the disk is diverse in shape and texture. It is leathery and entirely envelops the carpels until the middle of anthesis in the *P. suffruticosa* group, including *P. rockii*, *P. ostii*, *P. jishanensis*, *P. cathayana* and *P. qiui*, but fleshy and enveloping only the base of the carpels in *P. ludlowii* and *P. delavayi*. In *P. decomposita*, it is just in between, leathery but enveloping only half of the carpels. Stern (1946) divided tree peonies (sect. *Moutan*) into two subsections based on the disk: subsect. *Vaginatae* and subsect. *Delavayanae*. He failed to recognise *P. decomposita*, as he confused this species with *P. suffruticosa* in his sense.

For all the species in sect. *Paeonia*, the disk is very short, annular and fleshy. It varies in colour and shape: it can be white, yellow or red, and flat or wavy. Such variations are found within populations. The colour and form of the disk in herbaceous groups have not been used for taxonomy.

3.13 CARPELS

3.13.1 CARPEL NUMBER

The number of carpels is a character that is often used to distinguish angiosperm families. However, it varies greatly in *Paeonia*. Only in the *P. suffruticosa* group, which usually has five carpels in the wild, is the number nearly constant. All the other species have variable numbers of carpels. We found the

greatest variation within the population *D. Y. Hong et al.* H01014 from Corsica (*P. corsica*), where the number of carpels ranged from one to eight, but was mostly two or three. On the other hand, the number of carpels usually varies within a certain range. For example, *P. cambessedesii* has the greatest number of carpels in *Paeonia* (3–8, but mostly 4–6), whereas *P. ludlowii* has the smallest number (usually only 1, rarely 2 (in 3% of plants)), which distinguishes it from the closely related *P. delavayi* (2–4). In *P. algeriensis*, 34 of 60 (56.7%) individuals (or stems) observed had a single carpel, the remaining 26 (43.3%) had two. This character state differentiates *P. algeriensis* from the related *P. mascula* (which usually has 3–4 carpels). It is wise to use the character of carpel number with caution and with the aid of statistics.

3.13.2 CARPEL COLOUR

This character refers to the colour of the carpels themselves, not their indumentum. Carpels are usually green when young, but we found that their colour is polymorphic in several species. The *Paeonia lactiflora* populations *D. Y. Hong et al.* H03002 from Hebei Province and *D. Y. Hong et al.* H04040 from Inner Mongolia deserve to be mentioned in this context. In these two populations, purple-red, dark purple and green carpels were all seen frequently (Fig. 3.14). In *P. corsica*, the population *D. Y. Hong et al.* H01014 (Corsica) was found to have green and red carpels. No taxonomists have used this character to distinguish taxa.



Fig. 3.14. Polymorphism in carpel colour of *P. lactiflora* in the population *Hong et al.* H04040 (Mt Huanggangliang, Inner Mongolia).

3.14 STYLES AND STIGMAS

In *Paeonia*, the stigmas are consistently flattened and circinate, leaving the ventral suture outside the circle and the dorsal suture inside. In many species, e.g. *P. lactiflora*, *P. mascula* and *P. daurica*, the stigmas are always sessile or nearly sessile. The only case in which this character might be useful in taxonomy is in the *P. kesrouanensis*–*P. turcica* group, which has the longest styles in *Paeonia*. Davis and Cullen described *P. turcica* as new solely on the basis of this character. *Paeonia turcica* differs from *P. kesrouanensis*, they said, “in its somewhat shorter style and stigma, the stigmatic portion curved from near the base, instead of circinate only at the apex” (Davis & Cullen, 1965a) or, more precisely, “in having the style and stigma shorter, up to 5 mm, curved near the base” (Davis & Cullen, 1965b). We sampled four populations in Turkey including one (D. Y. Hong *et al.* H02207) from the type locality of *P. turcica* (Mt Boz Dag, Denizli Province), and found that the total length of styles and stigmas and curving position varied continuously, both between and within populations, and that there were no remarkable differences between “*P. turcica*” and *P. kesrouanensis* (Fig. 3.15). We found variation in these characters even within the population in the type locality of “*P. turcica*”.

On the other hand, we found that the length of styles in *Paeonia corsica* varied from 1 to 3 mm, and this became one of the diagnostic characters we used to distinguish *P. corsica* from *P. mascula* (stigmas sessile).

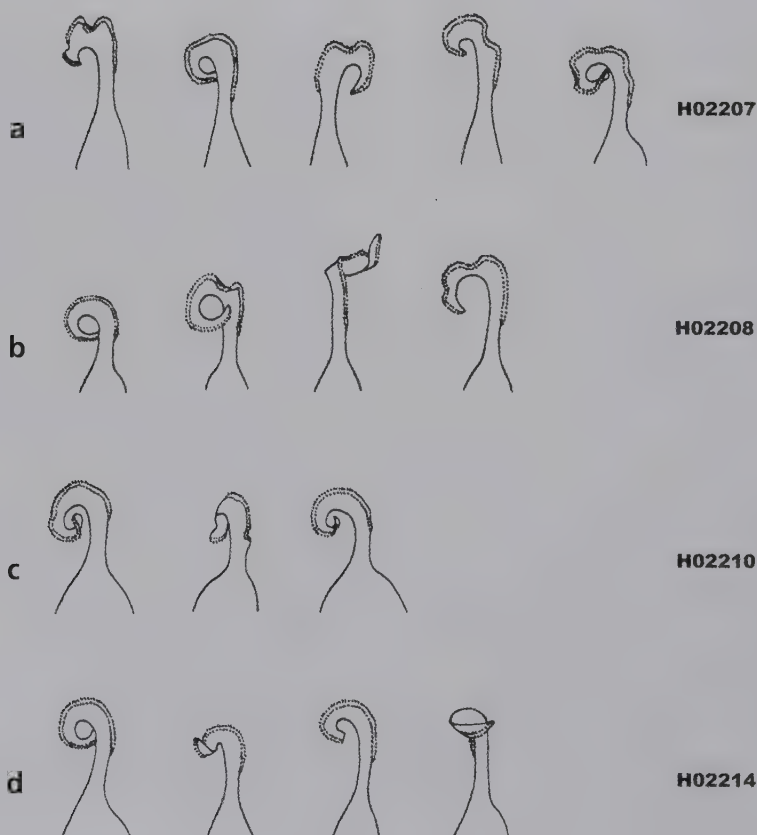


Fig. 3.15. Variations of styles and stigmas within and between populations in *Paeonia kesrouanensis* (including *P. turcica*).

3.15 FOLLICLES: SIZE

In *Paeonia*, follicles usually vary in length from 1.5 to 4 cm, and there are no distinct differences between species. However, one of the characters Hong (1997a) used for raising *P. lutea* var. *ludlowii* to *P. ludlowii* is the size of the follicles. *Paeonia ludlowii* has the largest follicles in *Paeonia*, which range from 4.5 to 7 cm in length. The second largest follicle is found in *P. algeriensis*, which has been confused with *P. coriacea* and *P. mascula*. *Paeonia algeriensis* was found to differ from the other two species in several characters, one of which is the size of follicles (mostly 4.5–5.4 cm long).

3.16 SEEDS: SHAPE AND SIZE

These two characters have never been used for taxonomy in *Paeonia*. Seeds are usually ovoid, spheroid or ellipsoid in the genus. The seeds of *P. ludlowii* and *P. algeriensis* are special, and much larger than those of their allies. They are about 11 mm in diameter in *P. ludlowii*, and 9 mm in diameter in *P. algeriensis*.

4. TAXONOMIC SYNOPSIS OF THE GENUS *PAEONIA*

(Abbreviations for books follow Stafleu & Cowan (1976–1988), and those for periodicals follow Lawrence *et al.* (1968) and Bridson & Smith (1991))

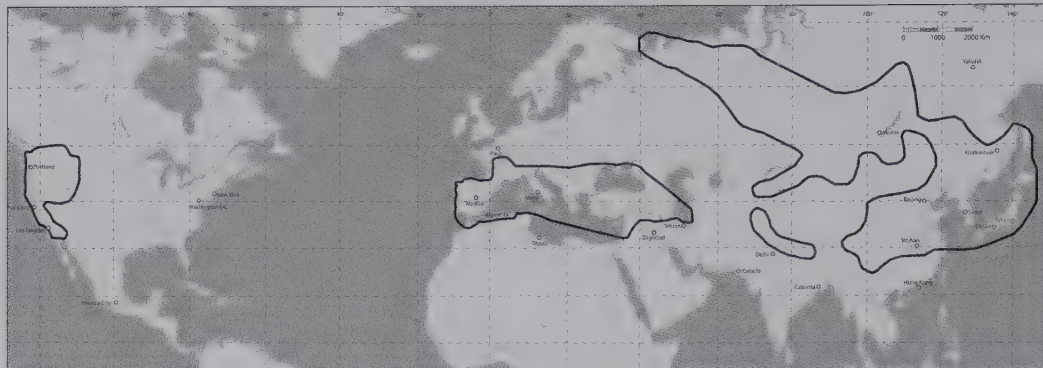
Paeonia L., *Sp. Pl.*, 530 (1753); Anderson, *Trans. Linn. Soc. London* 12(1): 248–283 (1818); de Candolle, *Syst. nat.*, 386–394 (1818); de Candolle, *Prodr.*, 65–66 (1824); Salm-Dyck, *Hort. Dyck.*, 364–371 (1834); Seringe, *Fl. Jard.* 3: 182–215 (1849); Baker, *Gard. Chron. n. ser.* 21: 732 (1884); Lynch, *J. Roy. Hort. Soc.* 12: 428–445 (1890); Huth, *Bot. Jahrb. Syst.* 14: 258–276 (1891); Schipczinsky, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2 (11–12): 41–47 (1921); Stebbins, *Univ. Calif. Publ. Bot.* 19: 245–266 (1939); Stern, *Study Gen. Paeonia*, 1–155 (1946); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Priro., Otd. Biol.* 92(3): 79–85 (1987); Halda, *Gen. Paeonia*, 45–170 (2004). TYPE: *Paeonia officinalis* L.

Perennial herbs or shrubs. Roots attenuate downward, less frequently tuberous-thickened in woody species (sect. *Moutan* DC.); all thickened, carrot-shaped, fusiform or tuberous in herbaceous species. Caudex of herbaceous species short, usually less than 10 cm, occasionally up to 17 cm long; aerial stems (of herbaceous species) simple or occasionally with a fertile or sterile branch at the base (sect. *Paeonia*), or usually branched (sect. *Onaepia* Lindl.). The lowest leaves always most developed, leaf size and number of leaflets diminishing toward top of stem; the lowest leaves always compound, ternate to quadriternate but mostly biternate, ternate-pinnate, biternate-pinnate, ternate-bipinnate or biternate-bipinnate; leaflets usually 9 or more (3 in *P. californica*, 7–9 in *P. cambessedesii*; up to 63 in *P. decomposita*), entire or often segmented, with segments up to 340 in *P. tenuifolia*. Flowers mostly solitary and terminal, less frequently in a cyme of 2–5, rarely solitary but with 1–3 undeveloped (sterile) flower buds in the axils. Leaves, involucral bracts, sepals and petals form a series; involucral bracts 1–6 in number, very rarely lacking; sepals 3–7 in number, various in shape and size, caudate or rounded at the apex; petals 4–14 in number, occasionally the outer one sepaloid, white, yellow, pink, red or dark purple; stamens numerous, from 20 to 280; filaments mostly purple, less frequently yellow; anthers yellow, rarely orange-red or dark purple; disk always present, either leathery and enveloping carpels halfway or entirely at anthesis or fleshy, either dentate or waved and enveloping only the base of the carpels; carpels free, varying from 1 to 8 in number, glabrous or tomentose, hairs various in length; styles obvious or lacking; stigmas flattened, circinate; ovules arranged in two rows along the ventral suture, 7–34 in number, no more than one-third developed. Follicles open ventrally. Seeds spheroid, ovoid or ellipsoid, black, blue-black or dark brown. Germination hypogeal.

CHROMOSOME NUMBER: $2n = 10$ (diploid) or $2n = 20$ (tetraploid).

DISTRIBUTION: All in the temperate region of the Northern Hemisphere, Eurasia, western N America and NW Africa, with the southern extreme at ca. 24°30' N (Jingdong, Yunnan Province, China: *Paeonia delavayi*) and the northern extreme at ca. 67°N (Kola peninsula and Kanin peninsula, Russia: *P. anomala* subsp. *anomala*) (Map 4.1).

HABITAT: Growing in oak, conifer, or mixed broad-leaved and conifer forests, thickets, or clearings, often on limestones but also on granites and other substrates. They are found at altitudes from 20 m in Mallorca, Spain (*Paeonia cambessedesii*) to 4,000 m in Daocheng, Sichuan Province, China (*P. delavayi*).



Map 4.1. Distribution of the genus *Paeonia*.

SUBDIVISION OF THE GENUS *PAEONIA*

Paeonia divides naturally into three groups, as treated by Lynch (1890), Stebbins (1939) and Stern (1946). Morphologically, the three are easily recognised (see the following key to sections). This division is now supported by molecular trees based on sequences of internal transcribed spacers (ITS) (nrDNA), the nuclear *Adh* gene family, *mat* K (a coding region of cpDNA) and *trn* H (an intergenic spacer of cpDNA). All show that the genus *Paeonia* comprises three major groups: 1) woody peonies; 2) herbaceous peonies in the New World; and 3) herbaceous peonies in the Old World (Sang *et al.*, 1995, 1997a, 1997b). Sectional rank was proposed for these groups by de Candolle (1824) and accepted by Salm-Dyck (1834), Stern (1946), and Uspenskaya (1987); subgeneric rank was proposed by Seringe (1849) and accepted by Lynch (1890), Stebbins (1939) and Halda (1997, 2004). Since the genus *Paeonia* comprises only 32 species according to our account, subdivision into three infrageneric levels, including either subgenera or series, as recognised by Uspenskaya (1987) (section, subsection and series) or by Halda (2004) (subgenus, section and subsection), is too fine a distinction to support. Therefore, we here adopt a two-ranked system for *Paeonia* with the two lower ranks of section and subsection. At the sectional level, we recognise three sections in *Paeonia*: sect. *Moutan* DC. (1824), sect. *Onaepia* Lindl. (1839) and sect. *Paeonia*.

Key to sections in *Paeonia*

- 1a. Shrubs; disk leathery and halfway to wholly enveloping carpels until mid-anthesis, or fleshy and short, enveloping only the base of carpels I. sect. *Moutan* DC.
- 1b. Herbaceous perennials; disk fleshy and short, enveloping only base of carpels
 - 2a. Petals nearly equal in size to or smaller than sepals; disk dentate, almost interrupted; lower leaves ternate or biternate, with leaflets 3 or 9, lateral roots slightly fusiform II. sect. *Onaepia* Lindl.
 - 2b. Petals much larger than sepals; disk annular, waved or flat; lower leaves biternate or triternate, with leaflets 9 or more; lateral roots carrot-shaped, fusiform or tuberous . . . III. sect. *Paeonia*

1. ***Paeonia* sect. *Moutan*** DC., *Prodr.* 1: 65 (1824); Stern, *Study Gen. Paeonia*, 2 (1946); Pan, *Fl. Reip. Pop. Sin.* 27: 39 (1977); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 82 (1987); Hong & Pan, *Acta Phytotax. Sin.* 37: 359 (1999). *Paeonia* subsect. *Fruticosae* Huth, *Bot. Jahrb. Syst.* 14: 272 (1891); Schipczinsky, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 43 (1921). *Paeonia* subg. *Moutan* (DC.) Ser., *Fl. Jard.* 3: 187 (1849); Baker, *Gard. Chron. n. ser.* 21: 779

(1884); Lynch, *J. Roy. Hort. Soc.* 12: 432 (1890); Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 28 (1997) and *Gen. Paeonia*, 141 (2004). TYPE: *Paeonia moutan* Sims (= *Paeonia suffruticosa* Andrews). *Paeonia* sect. *Suffruticosae* Salm-Dyck, *Hort. Dyck.*, 366 (1834). TYPE: not designated.

Shrubs to 3.5 m tall; stems always sympodial, the annual shoots dying back at the top. Flowers solitary or several per shoot, forming a cyme; sepals all caudate at the apex except in *Paeonia jishanensis*; disk low and fleshy or raised and leathery, enveloping carpels halfway or entirely until mid-anthesis. All diploid with $2n = 10$.

INCLUDED SPECIES (8 + 1 OF HYBRID ORIGIN): *Paeonia cathayana* D. Y. Hong & K. Y. Pan, *P. decomposita* Hand.-Mazz., *P. delavayi* Franch., *P. jishanensis* T. Hong & W. Z. Zhao, *P. ludlowii* (Stern & G. Taylor) D. Y. Hong, *P. ostii* T. Hong & J. X. Zhang, *P. qiui* Y. L. Pei & D. Y. Hong, *P. rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong, *P. suffruticosa* Andrews (an assemblage of cultivars of hybrid origin).

DISTRIBUTION: Native to China (Map 4.2).



Map 4.2. Distribution of *Paeonia* sect. *Moutan*.

Two subsectional groups are easily recognised (see the following key): subsect. *Vaginatae* Stern and subsect. *Delavayanae* Stern.

Key to species of *Paeonia* sect. *Moutan* DC.

- 1a. Flowers usually 2–4 in a cyme, more or less pendent; disk fleshy, enveloping only the base of the carpels; carpels always glabrous (1a. subsect. *Delavayanae* Stern.)
 - 2a. Carpels usually 2–5(–7); follicles less than 4 cm long, 1.5 cm in diameter; petals, filaments and stigmas often not purely yellow 2. *P. delavayi* Franch.
 - 2b. Carpels nearly always single, rarely 2; follicles 4.7–7 cm long, 2–3.3 cm in diameter; petals, filaments and stigmas always yellow 1. *P. ludlowii* (Stern & G. Taylor) D. Y. Hong

- 1b. Flowers solitary, erect; disk leathery, enveloping carpels halfway or completely until mid-anthesis; carpels tomentose or glabrous (Ib. subsect. *Vaginatae* Stern.)
- 3a. Disk enveloping carpels halfway until mid-anthesis; carpels 2–4(5), glabrous; lower leaves decompose with leaflets (29–)33–63 in number, all lobed 3. *P. decomposita* Hand.-Mazz.
- 3b. Disk completely enveloping carpels until mid-anthesis; carpels 5(–7), densely lanate or tomentose; lower leaves biternate, biternate-pinnate or ternate-bipinnate; leaflets usually fewer than 20(–33) in number, if more at least some of them entire
- 4a. Lower leaves biternate; leaflets 9 in number, very occasionally 11 or 15 in *P. jishanensis*
- 5a. Leaflets ovate or ovate-orbicular, mostly entire, often reddish above; petals often with a reddish blotch at the base 7. *P. qiui* Y. L. Pei & D. Y. Hong
- 5b. Leaflets oval, ovate or nearly orbicular, mostly or all lobed; green above; petals without a blotch at the base
- 6a. Leaflets oval or ovate, terminal leaflets 3- or 5-cleft, with additional 1 to several lobes, lateral leaflets mostly 2- or 3-lobed, less frequently entire; lobes acute at apex; leaves glabrous on lower surface; sepals all caudate or mucronate 8. *P. cathayana* D. Y. Hong & K. Y. Pan
- 6b. Leaflets ovate-orbicular to orbicular, all 3-cleft; segments lobed, acute to rounded at apex; leaves villose along veins on lower surface; sepals all rounded at apex 6. *P. jishanensis* T. Hong & W. Z. Zhao
- 4b. Lower leaves ternate-pinnate, ternate-bipinnate or biternate-pinnate; leaflets more than 9 in number, usually oval to lanceolate, mostly entire, less frequently oval-orbicular and mostly lobed
- 7a. Lower leaves ternate-pinnate; leaflets no more than 15 in number, ovate to ovate-lanceolate, mostly entire; petals white, rarely pale pink, without a blotch 5. *P. ostii* T. Hong & J. X. Zhang
- 7b. Lower leaves ternate-bipinnate (rarely biternate-pinnate); leaflets (17–)19–33 in number, lanceolate or ovate-lanceolate and mostly entire, or ovate to ovate-orbicular and mostly lobed; petals white, rarely red, always with a large, dark purple blotch at the base 4. *P. rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong

Ia. *Paeonia* subsect. *Delavayanae* Stern, *Study Gen. Paeonia*, 3 (1946); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 82 (1987). *Paeonia* subg. *Moutan* (DC.) Ser. sect. *Delavayanae* (Stern) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 29 (1997). *Paeonia* sect. *Paeon* ser. *Delavayanae* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 141 (1961). TYPE: *Paeonia delavayi* Franch.

Flowers several in a cyme. Floral disk fleshy, short, enveloping only the base of the carpels; carpels 1–5 in number.

INCLUDED SPECIES (2): *Paeonia delavayi* Franch. and *P. ludlowii* (Stern & G. Taylor) D. Y. Hong.

DISTRIBUTION: Southwestern China (Map 4.2).

Ib. *Paeonia* subsect. *Vaginatae* Stern, *Study Gen. Paeonia*, 2 (1946); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 82 (1987). *Paeonia* subg. *Moutan* (DC.) Ser. sect. *Moutan* (DC.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 28 (1997). TYPE: *Paeonia suffruticosa* Andrews.

Flowers solitary and terminal. Disk leathery, raised, enveloping carpels halfway or completely until mid-anthesis; carpels mostly 5 in number.

INCLUDED SPECIES (6): *Paeonia cathayana* D. Y. Hong & K. Y. Pan, *P. decomposita* Hand.-Mazz., *P. jishanensis* T. Hong & W. Z. Zhao, *P. ostii* T. Hong & J. X. Zhang, *P. qiui* Y. L. Pei & D. Y. Hong and *P. rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong and one cultivated species of hybrid origin, *P. suffruticosa* Andrews.

DISTRIBUTION: Distributed in central Anhui, eastern Gansu, Henan, western Hubei, Shaanxi, southwestern Shanxi, as well as in northern and northwestern Sichuan (Map 4.2).

II. *Paeonia* sect. *Onaepia* Lindl., *Bot. Reg.* 25: tab. 30 (1839); Reichenbach, *Repert. Herb. S. Nom. Gen. Pl.*, 191 (1841); Stern, *Study Gen. Paeonia*, 2 (1946); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987). *Paeonia* subg. *Onaepia* (Lindl.) Lynch, *J. Roy. Hort. Soc.* 12: 433 (1890); Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 28 (1997); Halda, *Gen. Paeonia*, 132 (2004). TYPE: *Paeonia brownii* Douglas ex Hook.

Paeonia sect. *Nearcticae* Huth, *Bot. Jahrb. Syst.* 14: 273 (1891); Schipczinsky, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 44 (1921). TYPE: *Paeonia brownii* Douglas ex Hook.

Perennials. Lateral roots slightly fusiform. Stems often branched. Lower leaves ternate or biternate. Flowers often several, terminal on main stem and branches; petals nearly equal in size to, or smaller than, sepals; disk dentate, almost interrupted, enveloping the base of the carpels until mid-anthesis; carpels 2–5 in number, always glabrous. Diploid with $2n = 10$.

INCLUDED SPECIES (2): *Paeonia brownii* Douglas ex Hook. and *P. californica* Nutt. ex Torr. & A. Gray.

DISTRIBUTION: *Paeonia* sect. *Onaepia* is endemic to western (Pacific) North America in the USA and Mexico (Map 4.3).

Key to species of *Paeonia* sect. *Onaepia* Lindl.

- 1a. Lower leaves biternate; leaf segments and final lobes 59–110 in number, acute to rounded at apex; carpels usually 5, rarely 3, 4 or 6 in number; sepals exceeding the petals 9. *P. brownii* Douglas ex Hook.
- 1b. Lower leaves ternate; leaf segments and final lobes 33–78 in number, mostly acute at apex; carpels usually 3, rarely 2 or 4; sepals slightly smaller than, or subequal to, the petals 10. *P. californica* Nutt. ex Torr. & A. Gray

III. *Paeonia* sect. *Paeonia* Pan, *Fl. Reip. Pop. Sin.* 27: 48 (1979); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 84 (1987). *Paeonia* sect. *Eupaeonia* Baillon, *Adansonia* 4: 56 (1863). *Paeonia* sect. *Tripaonia* Baillon, *Adansonia* 4: 56 (1863). TYPE: *Paeonia officinalis* L.

Paeonia sect. *Paeon* DC., *Prodr.* 1: 65 (1824); Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 548 (1923); Stern, *Study Gen. Paeonia*, 2 (1946); Fang, *Acta Phytotax. Sin.* 7: 318 (1958); Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 14 (1961), pro parte, excl. *Paeonia* ser. *Delavayanae*. TYPE: *Paeonia officinalis* L.

Paeonia sect. *Palaearticae* Huth, *Bot. Jahrb. Syst.* 14: 265 (1891), pro parte, excl. *Paeonia lutea*, *P. moutan* and *P. delavayi*. TYPE: *Paeonia albiflora* Pall. (= *P. lactiflora* Pall.) (lectotype here designated).

Paeonia sect. *Palaearticae* subsect. *Herbaceae* Huth, *Bot. Jahrb. Syst.* 14: 265 (1891); Handel-Mazzetti, *Acad. Wissenschaften Wien* 57: 265 (1920); Schipczinsky, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 41 (1921), syn. nov. TYPE: *Paeonia albiflora* Pall. (= *P. lactiflora* Pall.) (lectotype here designated).

Paeonia sect. *Palaearticae* Huth, emend. Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987), syn. nov. TYPE: *Paeonia mascula* (L.) Mill.

Paeonia sect. *Compactae* Salm-Dyck, *Hort. Dyck.* 366 (1834), syn. nov. TYPE: not designated.



Map 4.3. Distribution of *Paeonia* sect. *Onaepia*.

Paeonia sect. *Flavonia* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 18 (1961), pro parte, excl. ser. *Luteae*.
Paeonia subsect. *Flavonia* (Kem.-Nath.) M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987), in sect. *Palaearticae*. *Paeonia* subsect. *Flavonia* (Kem.-Nath.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 27 (1997), in subg. *Paeonia* sect. *Palaearticae*; Halda, *Gen. Paeonia*, 123 (2004), syn. nov. TYPE: *Paeonia wittmanniana* Hartwiss ex Lindl. (= *P. daurica* Andrews subsp. *wittmanniana* (Hartwiss ex Lindl.) D. Y. Hong).
Paeonia sect. *Sternia* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 35 (1961), syn. nov. TYPE: *Paeonia officinalis* L.

Paeonia subg. *Paeon* (DC.) Ser., *Fl. Jard.* 3: 193 (1849), pro parte, excl. *P. brownii* and *P. californica*; Lynch, *J. Roy. Hort. Soc.* 12: 434 (1890). TYPE: *Paeonia corallina* Retz. (= *P. mascula* (L.) Mill.).
Paeonia subg. *Paeonia* Baker, *Gard. Chron. n. ser.* 21: 779 (1884), pro parte, excl. *P. brownii*; Halda, *Gen. Paeonia*, 46 (2004). TYPE: *Paeonia officinalis* L.

Perennials. Lateral roots carrot-shaped, fusiform or tuberous. Lower leaves biternate or triternate. Flowers solitary and terminal or several to a stem; sepals caudate or rounded at the apex; disk annular, fleshy, enveloping only the base of carpels until mid-anthesis; carpels 1–8 in number, glabrous or lanate, tomentose, hispidulous or papillose.

INCLUDED SPECIES (22): *Paeonia algeriensis* Chabert, *P. anomala* L., *P. arietina* G. Anderson, *P. broteri* Boiss & Reut., *P. cambessedesii* (Willk.) Willk., *P. clusii* Stern, *P. coriacea* Boiss., *P. corsica* Sieber ex Tausch, *P. daurica* Andrews, *P. emodi* Wall. ex Royle, *P. intermedia* C. A. Mey., *P. kesrouanensis* (Thiébaud) Thiébaud, *P. lactiflora* Pall., *P. mairei* H. Lév., *P. mascula* (L.) Mill., *P. obovata* Maxim., *P. officinalis* L., *P. parnassica* Tzanoud., *P. peregrina* Mill., *P. saueri* D. Y. Hong, X. Q. Wang & D. M. Zhang, *P. sterniana* H. R. Fletcher, *P. tenuifolia* L.

DISTRIBUTION: *Paeonia* sect. *Paeonia* is distributed in temperate Eurasia and northwestern Africa in Morocco and Algeria (Map 4.4).

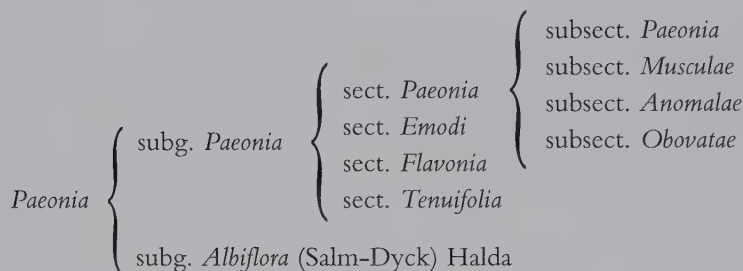


Map 4.4. Distribution of *Paeonia* sect. *Paeonia*.

DIVISION OF *PAEONIA* SECT. *PAEONIA*

The subdivision of *Paeonia* sect. *Paeonia* has been controversial. The first subdivision was made by Salm-Dyck (1834), who recognised seven sections in this group using characters such as the number of flowers per stem, the leaflets partite or not, the shape of leaf blades, and leaf indumentum. Baker (1884) informally divided all herbaceous peonies into three sections according to indumentum (glabrous or tomentose) and status of follicles (erect or spreading when mature). Stern (1946) recognised two subsections in sect. *Paeonia*, subsection. *Foliolatae* and subsection. *Dissectifoliae*, which were based on the number of leaflets or segments of lower leaves. Kemularia-

Nathadze (1961) grouped sect. *Paeonia* into three sections on the basis of petal colour, division of leaves (biternate or triternate): sect. *Flavonia* (including a woody series, ser. *Luteae*), sect. *Paeon* (including a woody series, ser. *Delavayanae*), and sect. *Sternia*. Uspenskaya (1987) divided sect. *Paeonia* into three sections, lumping Kemularia–Nathadze’s sect. *Flavonia* and sect. *Paeon* into a single section, *Palaearticae*. She accepted Salm-Dyck’s *Albiflorae* as a section, emphasising the character of the leaf margin of *P. lactiflora*. Halda (2004) recognised two subgenera, four sections and four subsections in this section as follows:



As described in Chapter 3, morphological polymorphism can account for a range of petal colours within a single population (Fig. 3.13) and for the glabrous or hairy characters of the carpels and follicles (Figs 3.9, 3.10). Thus, Salm-Dyck’s (1834) and Kemularia–Nathadze’s (1961) subdivisions of sect. *Paeonia* are artificial. Uspenskaya’s (1987) subdivision is more rational, though her decision to separate *P. anomala* and its allies from *P. lactiflora* is not justified.

Halda’s (2004) classification separates a number of closely related taxa into different sections or even subgenera. Some examples: *Paeonia mlokosewitschii* (= *P. daurica* subsp. *mlokosewitschii*) is in sect. *Flavonia*, whereas *P. lagodechiana* is in sect. *Paeonia* (they were actually two colour forms in the same population from Lagodekhi, Georgia); *P. parnassica* is so closely related to *P. arietina* that it may even be treated as a subspecies of species *P. arietina*, but Halda places *P. parnassica* in subsect. *Paeonia* and *P. arietina* in subsect. *Masculae*; *P. lactiflora*, *P. anomala* (including subsp. *veitchii*), *P. emodi* and *P. sterniana* are closely related, sharing a number of characters, but Halda (2004) separates them into two subgenera, subg. *Albiflora* and subg. *Paeonia*, the latter with two sections, sect. *Paeonia* and sect. *Emodi*.

On the other hand, Halda’s system pulls distant entities together in a single subsection. For example, *P. anomala* and *P. hybrida* sensu Halda (= *P. intermedia*) are both in subsect. *Anomalaе*; *P. clusii* (including *P. rhodia*), *P. parnassica*, *P. peregrina* and *P. officinalis* are pulled together into subsect. *Paeonia*.

Stern’s (1946) subdivision of sect. *Paeonia* into two subsections according to division of leaves is too simple, failing to recognize important characters such as number of flowers per stem, shape of sepals and form of roots.

Molecular analysis based on ITS (nrDNA) and *matK* (coding region of cpDNA) (Sang *et al.*, 1995, 1997a) implies that there are three groups in the section. On the basis of both morphology and DNA sequences, therefore, we here divide the section *Paeonia* into three subsections: subsect. *Paeonia*, subsect. *Albiflorae* and subsect. *Foliolatae*.

IIIa. *Paeonia* subsect. *Albiflorae* (Salm-Dyck) D. Y. Hong, stat. nov. *Paeonia* sect. *Albiflorae* Salm-Dyck, *Hort. Dyck.*, 366 (1834); Uspenskaya, *Byull. Moskovsk. Obshch. Isp. Priro., Otd. Biol.* 92(3): 82 (1987). *Paeonia* subg. *Albiflora* (Salm-Dyck) Halda, *Acta Mus. Richnov., Sect. Nat.* 5(1): 4 (1998); Halda, *Gen. Paeonia*, 128 (2004). TYPE: *Paeonia albiflora* Pall. (= *P. lactiflora* Pall.).

Paeonia sect. *Emodi* Halda, *Acta Mus. Richnov., Sect. Nat.* 5(1): 4 (1998); Halda, *Gen. Paeonia*, 119 (2004), syn. nov. TYPE: *Paeonia emodi* Wall. ex Royle.

Paeonia ser. *Anomalae* Kem.-Nath. ex M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 84 (1987), in sect. *Paeonia*. *Paeonia* subsect. *Anomalae* (Kem.-Nath. ex M. S. Uspensk.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 26 (1997), in subg. *Paeonia* sect. *Paeonia*, syn. nov. TYPE: *Paeonia anomala* L.

Paeonia ser. *Chinensis* Kom. ex Schipcz. in Komarov, *Fl. USSR* 7: 25 (1937), syn. nov. TYPE: *Paeonia albiflora* Pall. (= *P. lactiflora*).

Paeonia ser. *Dentatae* Kom. ex Schipcz. in Komarov, *Fl. USSR* 7: 33 (1937), pro parte, excl. *P. hybrida*, syn. nov. TYPE: *Paeonia anomala* L. (lectotype here designated).

Roots more or less carrot-shaped. Leaves glabrous or with bristles along veins on the upper surface. Flowers usually several per stem, rarely solitary, or solitary but with undeveloped (sterile) flower buds at axils; sepals mostly caudate at the apex. Almost all diploid with $2n = 10$ (*P. emodi* with a tetraploid population, $2n = 20$, in Xizang (Tibet)).

INCLUDED SPECIES (4): *Paeonia anomala* L., *P. emodi* Wall. ex Royle, *P. lactiflora* Pall., *P. sterniana* H. R. Fletcher.

DISTRIBUTION: All species in *Paeonia* subsect. *Albiflorae* are found in Asia, with the range of *P. anomala* extending into northeastern Europe (Map 4.4).

IIIb. *Paeonia* subsect. *Foliolatae* Stern, *Study Gen. Paeonia*, 3 (1946), pro parte, excl. *P. lactiflora*, *P. emodi*, *P. arietina* and *P. banatica*. *Paeonia* sect. *Palaearticae* subsect. *Foliolatae* (Stern) M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir. Otd. Biol.* 92(3): 83 (1987). *Paeonia* subg. *Paeonia* sect. *Palaearticae* subsect. *Foliolatae* (Stern) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 27 (1997). TYPE: *Paeonia mascula* (L.).

Paeonia sect. *Corallinae* Salm-Dyck, *Hort. Dyck*, 366 (1834), syn. nov. TYPE: not designated.

Paeonia ser. *Corallinae* Kom. ex Schipcz. in Kom., *Fl. USSR* 7: 28 (1937), syn. nov. TYPE: *Paeonia triternata* Pall. (= *P. daurica* Andrews) (lectotype here designated).

Paeonia sect. *Flavonia* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 18 (1961), pro parte, excl. ser. *Luteae*. *Paeonia* sect. *Palaearticae* subsect. *Flavonia* (Kem.-Nath.) M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987). *Paeonia* subg. *Paeonia* sect. *Palaearticae* subsect. *Flavonia* (Kem.-Nath.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 27 (1997), syn. nov. TYPE: *Paeonia macrophylla* (Albov) Lomakin (= *P. daurica* Andrews subsp. *macrophylla* (Albov) D. Y. Hong).

Paeonia sect. *Paeon* auct. non DC.: Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 14 (1961), pro parte, excl. ser. *Delavayanae*.

Paeonia subg. *Paeonia* sect. *Paeonia* subsect. *Masculae* (M. S. Uspensk.) Halda, *Gen. Paeonia*, 63 (2004). *Paeonia* sect. *Palaearticae* subsect. *Foliolatae* ser. *Masculae* Stern ex M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987), syn. nov. TYPE: *Paeonia mascula* (L.) Mill.

Paeonia sect. *Palaearticae* subsect. *Obovatae* (Kom. ex Schipcz.) M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 84 (1987). *Paeonia* subg. *Paeonia* sect. *Palaearticae* subsect. *Obovatae* (Kom. ex Schipcz.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 28 (1997). *Paeonia* subg. *Paeonia* sect. *Paeonia* subsect. *Obovatae* (Kom. ex Schipcz.) Halda, *Gen. Paeonia*, 106 (2004). *Paeonia* ser. *Obovatae* Kom. ex Schipcz. in Kom., *Fl. USSR* 7: 26 (1937), syn. nov. TYPE: *Paeonia obovata* Maxim.

Paeonia sect. *Palaearticae* subsect. *Foliolatae* ser. *Macrophyllae* (Kem.-Nath.) M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987). *Paeonia* sect. *Flavonia* ser. *Macrophyllae* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 18 (1961), syn. nov. TYPE: *Paeonia macrophylla* (Albov) Lomakin (= *P. daurica* Andrews subsp. *macrophylla* (Albov) D. Y. Hong).

Paeonia sect. *Palaearticae* subsect. *Flavonia* ser. *Wittmannianae* (Stern ex Kam.-Nath.) M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 83 (1987). *Paeonia* sect. *Flavonia* ser. *Wittmannianae* Kem.-Nath., *Trudy Tbilissk Bot.* 21: 22 (1961), syn. nov. TYPE: *Paeonia wittmanniana* Hartwiss ex Lindl. (= *P. daurica* Andrews subsp. *wittmanniana* (Hartwiss ex Lindl.) D. Y. Hong).

Roots carrot-shaped. Lower leaves biternate; leaflets/leaf segments usually numbering 9 or more but fewer than 21 (up to 32 in *P. broteri* and 95 in *P. clusii*); leaves always glabrous above. Flowers always solitary and terminal; sepals mostly rounded at the apex. Both diploid and tetraploid with $2n = 10$ and $2n = 20$.

NUMBER OF SPECIES (11): *Paeonia algeriensis*, *P. broteri*, *P. cambessedesii*, *P. clusii*, *P. coriacea*, *P. corsica*, *P. daurica*, *P. kesrouanensis*, *P. mairei*, *P. mascula* and *P. obovata*.

DISTRIBUTION: Disjunct; in E Asia (Japan, Korea peninsula, the Russian Far East and China) and in Europe, NW Africa and W Asia (from the western Mediterranean to Iran) (Map 4.4).

IIIc. *Paeonia* subsect. *Paeonia*

Paeonia sect. *Compactae* Salm-Dyck, *Hort. Dyck*, 366 (1834), syn. nov.

Paeonia sect. *Microcarpae* Salm-Dyck, *loc. cit.*, syn. nov.

Paeonia sect. *Paeonia* subsect. *Dissectifoliae* Stern, *Gen. Paeonia*, 7 (1946), pro parte, excl. *P. clusii*, *P. anomala* and *P. veitchii*. *Paeonia* ser. *officinalis* Kem.-Nath. ex M. S. Uspensk., *Byull. Moshch. Obshch. Isp. Prir., Otd. Biol.* 92(3): 84 (1987), as sect. *Paeonia*, syn. nov. TYPE: *Paeonia officinalis* L.

Paeonia sect. *Lobatae* Salm-Dyck, *loc. cit.*, syn. nov.

Paeonia sect. *Laciniatae* Salm-Dyck, *loc. cit.*, syn. nov.

Paeonia sect. *Tenuifoliae* (Stern ex M. S. Uspensk.) Halda, *Acta Mus. Richnov., Sect. Nat.* 5(1): 4 (1998), in subg. *Paeonia*. *Paeonia* subsect. *Tenuifoliae* (Stern ex M. S. Uspensk.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 27 (1997), in subg. *Paeonia* sect. *Paeonia*. *Paeonia* ser. *Tenuifoliae* Stern ex M. S. Uspensk., *Byull. Moshch. Obshch. Isp. Prir., Otd. Biol.* 92(3): 84 (1987), in sect. *Paeonia*, syn. nov. TYPE: *Paeonia tenuifolia* L. (lectotype here designated).

Paeonia sect. *Sternia* Kem.-Nath., *Trudy Tbilissk. Bot. Inst.* 21: 35 (1961), syn. nov. TYPE: *Paeonia officinalis* L.

Paeonia sect. *Palaearticae* subsect. *Foliolatae* ser. *Arietinae* Stern ex M. S. Uspensk., *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 92(3): 84 (1987), syn. nov. TYPE: *Paeonia arietina* G. Anderson.

Paeonia ser. *Fissae* Kom. ex Schipcz. in Komarov, *Fl. USSR* 7: 34 (1937), syn. nov. TYPE: *Paeonia tenuifolia* L.

Paeonia subg. *Paeonia* sect. *Paeonia* subsect. *Paeonia* sensu Halda, *Gen. Paeonia*, 48 (2004), pro parte, excl. *P. clusii* Stern and *P. rhodia* Stearn.

Lateral roots fusiform or tuberous. Lower leaves biternate or triternate; leaflets nearly always segmented with leaflets/leaf segments (9–)21–340 in number; leaves mostly with bristles along veins above. Flowers solitary and terminal; sepals mostly rounded at the apex. Mostly tetraploid (diploid only in *P. intermedia* and *P. tenuifolia*).

NUMBER OF SPECIES (7): *Paeonia arietina*, *P. intermedia*, *P. officinalis*, *P. parnassica*, *P. peregrina*, *P. saueri* and *P. tenuifolia*.

DISTRIBUTION: From Central Asia to the northern Mediterranean (Map 4.4).

Key to species of *Paeonia* sect. *Paeonia*

- 1a. Flowers several to a stem, less frequently solitary but with 1–2 undeveloped flower buds at axils, rarely really solitary; sepals mostly caudate at apex; leaves usually with bristles along veins above (IIIa. subsect. *Albiflorae* (Salm-Dyck) D. Y. Hong)
 - 2a. Leaves cartilaginous and denticulate on margin, pubescent along veins or glabrous beneath; carpels glabrous, very rarely hairy 11. *P. lactiflora* Pall.
 - 2b. Leaves smooth on margin, glabrous beneath; carpels glabrous or hairy
 - 3a. Leaflets/leaf segments of lower leaves 70–100 in number, 0.8–3.2 cm wide 14. *P. anomala* L.
 - 3b. Leaflets/leaf segments of lower leaves fewer than 30 in number, 1.5–3.8 cm wide
 - 4a. Carpels 1, rarely 2 in number, mostly tomentose, less frequently glabrous; flowers often several per stem 12. *P. emodi* Wall. ex Royle
 - 4b. Carpels mostly 2 or 3 in number, rarely 4, always glabrous; flowers nearly always solitary, rarely 2 in number, but sometimes with 1–2 undeveloped flower buds at axils 13. *P. sterniana* H. R. Fletcher
- 1b. Flowers always solitary and terminal; sepals mostly rounded at apex; leaves glabrous or with bristles along veins above
 - 5a. Lateral roots always tuberous; leaflets/leaf segments of lower leaves mostly more than 20 in number, rarely fewer; leaves covered with bristles along veins above, or, if glabrous above, nearly always villose beneath (IIIc. subsect. *Paeonia*)
 - 6a. Stems mostly hirsute; sepals mostly hairy on abaxial side; leaves always glabrous or rarely villose at base above
 - 7a. Leaflets/leaf segments of lower leaves mostly more than 20, very rarely as few as 11 in number, linear-elliptic or lanceolate; sepals hispidulous or glabrous on abaxial side 32. *P. officinalis* L.
 - 7b. Leaflets/leaf segments of lower leaves mostly less than 20, occasionally up to 32 in number; elliptic, oblong or ovate-lanceolate; sepals densely villose on abaxial side
 - 8a. Flowers rose to red; anthers yellow; leaflets/leaf segments of lower leaves 11–25, occasionally up to 32 in number 30. *P. arietina* G. Anderson
 - 8b. Flowers dark purple; anthers orange; leaflets/leaf segments of lower leaves 9–15, occasionally up to 25 in number 31. *P. parnassica* Tzanoud.
 - 6b. Stems glabrous; sepals always glabrous; leaves mostly with bristles along veins above
 - 9a. Leaflets/leaf segments always dentate-lobed, with lobes less than 1 cm long; stigmas yellow or pale pink 28. *P. peregrina* Mill.
 - 9b. Leaflets/leaf segments entire or rarely deeply lobed; stigmas red
 - 10a. Leaflets/leaf segments of lower leaves 19–45 in number; leaves hispidulous beneath 29. *P. saueri* D. Y. Hong, X. Q. Wang & D. M. Zhang
 - 10b. Leaflets/leaf segments of lower leaves more than 70 in number; leaves always glabrous beneath
 - 11a. Leaflets/leaf segments of lower leaves 130–340 in number, mostly filiform, 0.5–8 mm wide 27. *P. tenuifolia* L.
 - 11b. Leaflets/leaf segments of lower leaves 70–100 in number, linear, 4–18 mm wide 26. *P. intermedia* C. A. Mey.
 - 5b. All roots carrot-shaped; leaflets/leaf segments of lower leaves numbering up to 21 (up to 32 in *P. broteri*), broad-elliptic, ovate, oblong or obovate (only in *P. clusii* 23–95 in number, linear, lanceolate to ovate); leaves always glabrous above (IIIb. subsect. *Foliolatae* Stern)

- 12a. Leaflets/leaf segments of lower leaves 23–95 in number, linear to ovate . . 19. *P. clusii* Stern
- 12b. Leaflets/leaf segments of lower leaves numbering less than 21 (32 in *P. broteri*), broad-elliptic to obovate
 - 13a. Leaflets/leaf segments acuminate to caudate-acuminate at apex; carpels densely brown-papillose or hispidulous, rarely glabrous 22. *P. mairei* H. Lév.
 - 13b. Leaflets/leaf segments acute to mucronate at apex; carpels tomentose or glabrous
 - 14a. Lower leaves with 9 or fewer leaflets; carpels always glabrous
 - 15a. Carpels 3–8, mostly 4–6 in number; plants purple-red and glabrous throughout 16. *P. cambessedesii* (Willk.) Willk.
 - 15b. Carpels mostly 2 or 3, rarely 1, 4 or 5 in number; plants usually green; leaves more or less hirsute beneath 15. *P. obovata* Maxim.
 - 14b. Lower leaves usually with 10–15 leaflets or segments, less frequently 9 or more; carpels mostly tomentose
 - 16a. Carpels 1, less frequently 2 in number, nearly always glabrous, very occasionally sparsely hairy; follicles columnar, 4–5.4 cm long . . . 25. *P. algeriensis* Chabert
 - 16b. Carpels (1)2–4 in number, rarely more, mostly tomentose; follicles long-ovoid or ellipsoid, up to 4 cm long
 - 17a. Styles 1.5–3.5 mm long; leaflets/leaf segments of lower leaves 11–14, rarely up to 17 in number, densely or sparsely villose beneath; carpels always glabrous 23. *P. kesrouanensis* (Thiérbaut) Thiérbaut
 - 17b. Styles usually absent (only in *P. corsica* 1.5–3 mm long); leaflets/leaf segments of lower leaves 9–20 in number, glabrous, sparsely hispid, puberulent or villose beneath; carpels tomentose or glabrous
 - 18a. Carpels always lanate or tomentose with hairs 2–3 mm long; styles absent
 - 19a. Leaflets usually entire, leaflets/leaf segments of lower leaves 9, rarely 10, very occasionally 11 in number, usually obovate, nearly truncate with a mucro or rounded, less frequently acute at apex 20. *P. daurica* Andrews
 - 19b. Leaflets at least some segmented, leaflets/leaf segments of lower leaves usually numbering 10 or more, very occasionally 9, usually acute at apex
 - 20a. Leaflets/leaf segments of lower leaves mostly (11)15–21, rarely up to 32 in number, 4–10(–15) cm long, 1.5–5(–6.5) cm wide; leaves always glabrous; hairs on carpels 2 mm long 18. *P. broteri* Boiss. & Reut.
 - 20b. Leaflets/leaf segments of lower leaves mostly (9)11–15, rarely up to 21 in number, 9–18 cm long, 4.5–9 cm wide; leaves sparsely hispid or glabrous; hairs on carpels 3 mm long 21. *P. mascula* (L.) Mill.
 - 18b. Carpels glabrous or tomentose with hairs 1.5 mm long; leaves glabrous or villose beneath
 - 21a. Carpels tomentose, rarely glabrous; leaflets/leaf segments of lower leaves usually 9, rarely up to 20 in number, villose beneath; styles 1.5–3 mm long 17. *P. corsica* Sieber ex Tausch
 - 21b. Carpels glabrous, very occasionally sparsely hairy; leaflets/leaf segments of lower leaves 10–15 in number, glabrous, very occasionally sparsely hairy (hairy leaves always accompanied by hairy carpels); styles lacking 24. *P. coriacea* Boiss.

5. DESCRIPTIONS OF SPECIES

I – IIa. PAEONIA sect. MOUTAN subsect. DELAVAYANAE Stern (species 1 and 2)

1. *Paeonia ludlowii* (Stern & G. Taylor) D. Y. Hong, *Novon* 7 (2): 157, figs 1, 2 (1997); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 130 (2001); Haw, *The New Plantsman* 8: 168 (2001). Basionym: *Paeonia lutea* Delavay ex Franch. var. *ludlowii* Stern & G. Taylor, *J. Roy. Hort. Soc.* 76: 217 (1951); Stern & Taylor, *Bot. Mag.* 169: tab. 209 (1953). *Paeonia lutea* Delavay ex Franch. subsp. *ludlowii* (Stern & G. Taylor) Halda, *Acta Mus. Richnov., Sect. Nat.* 6(3): 234 (1999). *Paeonia ludlowii* (Stern & G. Taylor) J. J. Li & D. Z. Chen in Li *et al.*, *Bull. Bot. Res. Harbin* 18(2): 154 (1998). TYPE: China, SE Xizang [Tibet]: “Kongbo Prov., Miling, Tsangpo Valley”, 28 May 1938, F. Ludlow, G. Sherriff & G. Taylor 4540 (holotype BM!); China, Xizang [Tibet], Charme, Char Chu, 28°26'N, 93°05'E, 3,320 m, 22 Oct. 1938, F. Ludlow, G. Sherriff & G. Taylor 6392 (paratype BM!); Lung-Chayue Chu, 2,900 m, 28 Apr. 1936, F. Ludlow & G. Sherriff 1376 (paratype BM!).

Paeonia lutea auct. non Delavay ex Franch.: Stern, *J. Roy. Hort. Soc.* 72: 394, fig. 157 (1947).

Deciduous and caespitose shrubs, up to 3.5 m tall, glabrous throughout. Roots attenuate downward, not fusiform. Stems grey, up to 4 cm in diameter. Shoots green, with 8–12 scales at the base. Lower leaves biternate, green above, pale glaucous beneath; petioles 8–18 cm long; leaflets 9, lateral 3 leaflets on each side with main petiolules 2–3.5 cm long, terminal 3 leaflets with main petiolules 5–11 cm long; leaflets nearly sessile, but not decurrent, 6–19 cm long, 5–15 cm wide, 3-segmented to halfway or nearly to the base; segments 4–12 cm long, 1.5–5.5 cm wide, mostly 3-lobed to the middle; lobes 2–5 cm long, 0.5–2.5 cm wide, entire or with 1 or 2 teeth, segments, lobes, and teeth all acuminate at the apex. Flowers 3 or 4 on each shoot, both terminal and axillary, with the terminal one blooming first, forming a cyme; pedicels slightly curved, 5–14 cm long, naked or with a leafy bract; involucre bracts 4 or 5, green; sepals 3 or 4, grading into one another, all or all except one caudate at the apex; petals pure yellow, spreading, obovate rounded at the apex, 4–5.5 cm long, 2.5–3.5 cm wide; filaments yellow, 1.1–1.5 cm long, anthers yellow, c. 4 mm long; disk fleshy, 1 mm high, yellow, wavy; carpels mostly single, very rarely 2; stigmas sessile, yellow. Follicles cylindrical, 4.7–7 cm long, 2–3.3 cm in diameter. Seeds kidney-shaped, dark brown, c. 1.5 cm long, 1.2 cm in diameter. Figs 5.1A, 5.1B, 5.1C, 5.1D.

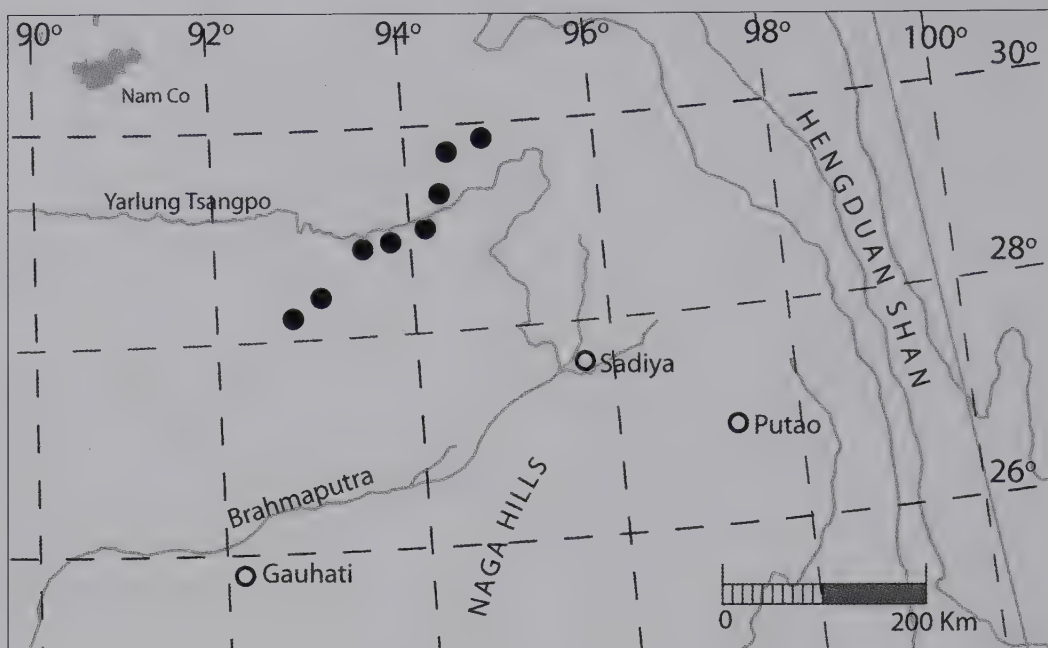
PHENOLOGY. Flowering from late May to early June and fruiting in September.

CHROMOSOME NUMBER. $2n = 10$ (Okada & Tamura, 1979; Li *et al.*, 1998).

HABITAT AND DISTRIBUTION. *Paeonia ludlowii* was collected from sparse forests and thickets, on granites at altitudes of 2,870–3,450 m. This is a narrow endemic in southeastern Xizang (Tibet) and known from Nyingchi, Mailing, and Lhünzê counties at 28.4–29.9°N, 92.4–94.8°E.

This species is also a medicinal plant and is often dug out by local people for its root bark. In three of the five populations studied (D. Y. Hong *et al.* H96007, H96014, H96030), hundreds of individuals were dug out by people from Gansu and Qinghai provinces (Hong, 1997a: fig. 2). This has caused a serious threat to the survival of this species. Effective measures must be taken to conserve this beautiful flower. Map 5.1.

NOTES. In the description of *Paeonia lutea* var. *ludlowii*, Stern and Taylor (1951, 1953) indicated that the taxon was distinctly different from the variety *lutea*, distinguished by its long, commonly



Map 5.1. Distribution of *Paeonia ludlowii* (Stern & G. Taylor) D. Y. Hong.

unbranched stems to 8 feet (2.4 m) vs. 5 feet (1.5 m) in var. *lutea*, its larger and more open flowers, with up to 2 carpels that are twice as large as those of var. *lutea*. These differences have been confirmed upon examination of plants in five populations in Mailing and Nyingchi counties and five populations of var. *lutea* (= *P. delavayi*). As shown in Hong (1997a: figs 1 and 2), plants of *P. ludlowii* are tall from a caespitose base, and have relatively large, pure yellow flowers, yellow filaments, acuminate leaf segments and lobes, and typically one carpel per flower (more than 97% of the flowers examined had a single carpel and fewer than 3% had two). Furthermore, *P. ludlowii* produces very large follicles that contain the largest seeds in the genus. By contrast, plants of *P. delavayi* are not caespitose and have much shorter stems, acute leaf lobes and segments, smaller flowers, yellow petals that are nearly always red-blotched at the base, purple-red filaments, and three or four, rarely two, much smaller carpels. These differences clearly support the recognition of the variety *ludlowii* as a distinct taxon and species.

Paeonia ludlowii is a tall shrub that often forms large and dense clumps with dozens of stems. A single individual can have up to 105 flowers (Hong, 1997a: fig. 2). All of the five populations studied were small in area, and the largest population was about 200 m in diameter. Except for the Quenima Village population (D. Y. Hong *et al.* H96020), which had only four individuals, all the populations observed consisted of many rather densely packed individuals, and the species was a dominant element in the community. Two factors may explain the small population areas that contain a large number of individuals. First, this species has a high seed-set, and its seeds appear to have a high germination rate. Nearly 100 seedlings were found in an area of a square meter under a large individual in the Nanyigou population (D. Y. Hong *et al.* H96030). Second, the seeds of *P. ludlowii* are large (ca. 1.2 cm diameter) and are not adapted to long-distance dispersal; perhaps they are mostly moved by rats. The species is





Fig. 5.1B. *Paeonia ludlowii* (Stern & G. Taylor) D. Y. Hong: a lower leaf. Drawn by Miss LI Ai-Li.

obligately sexual, and no vegetatively produced individuals or plantlets have been found in any of the populations. More than 20 small plantlets were dug out, and all were found to be seedlings, a sharp contrast to *P. delavayi*, which reproduces both sexually and vegetatively.

ADDITIONAL SPECIMENS EXAMINED. CHINA, XIZANG [TIBET], Lhünzê County, Qayu, Zuanbadala, 3,450 m, Qinghai-Xizang Exped. 750450 (KUN, PE). Mainling: Gongga, 4 km E of Gongga Bridge, 29.3°N, 94.4°E, 2,900 m, 24 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96005 (A, K, MO, PE, US); loc. eodem, 17 May 2006, D. Y. Hong & A. S. Xu H06013 (PE); Zhare Township, Caimu Village, N of Yarlung Zangbo (River), 29.2°N, 94.3°E, 2,980 m, 24 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96007 (A, K, MO, PE, US); between Gongga and Mailing, S of Yarlung Zangbo (River), 29.2°N, 94.2°E, 3,000 m, 24 May 1996,

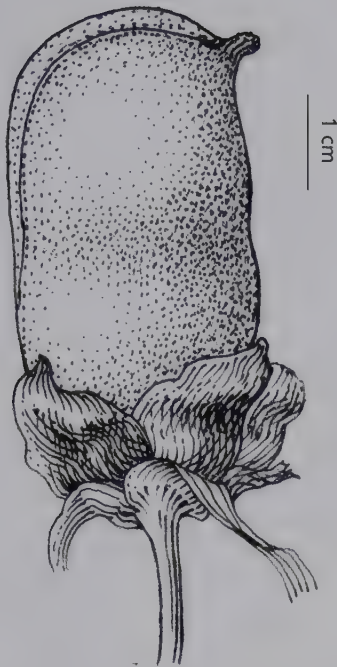


Fig. 5.1C. A single follicle of *Paeonia ludlowii*.
Drawn by Miss ZHANG Tai-Li.

D. Y. Hong, Y. B. Luo & S. R. Zhang H96014 (A, K, MO, PE, US); *loc. eodem*, 17 May 2006, *D. Y. Hong & A. S. Xu* H06014 (PE); *loc. eodem*, 2,900 m, 22 May 1990, *W. L. Zheng* 22 (XE); Nanyi Township, Nanyigou, 29.2°N, 94.1°E, 2,950 m, 29 May 1996, *D. Y. Hong, Y. B. Luo & S. R. Zhang* H96030 (A, K, MO, PE, US); *loc. eodem*, in forests, 3,300 m, 9 June 1995, *W. L. Zheng* 673 (XE); Regagou, 2,870 m, *Xizang Inst. Ecol.* 186 (XE). **Nyingchi:** Bayizhen, Juemugou, in bushes, 2,950 m, 29 May 1989, *Yao, Tang, Zheng & Pan* 1005 (XE); *loc. eodem*, 3,000 m, in bushes, 20 May 1990, *W. L. Zheng* 19 (XE); Deying Distr., by village, 3,050 m, 13 June 1972, *Xizang Chinese Materia Medica & Herbs Exped.* 3296 (PE); Dongjug Township, Quenima Village, 29.9°N, 94.8°E, 3,100 m, 26 May 1996, *D. Y. Hong, Y. B. Luo & S. R. Zhang* H96020 (A, K, MO, PE, US).



Fig. 5.1D. *Paeonia ludlowii* (Stern & G. Taylor) *D. Y. Hong*: involucrate bracts and sepals, based on *D. Y. Hong, Y. B. Luo & S. R. Zhang* H96005 (A, K, MO, PE, US). Drawn by Mr SUN Yin-Bao.

2. *PAEONIA DELAVAYI*

2. *Paeonia delavayi* Franch., *Bull. Soc. Bot. France* 33: 382 (1886); Stern, *Study Gen. Paeonia*, 44 (1946); Fang, *Acta Phytotax. Sin.* 7(4): 316 (1958); Pan, *Fl. Reip. Pop. Sin.* 27: 47, pl. 5 (1979); Hong, Pan & Yu, *Ann. Missouri Bot. Gard.* 85: 561 (1998); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 130 (2001); Haw, *The New Plantsman* 8: 167, 252 (2001). TYPE: China, NW Yunnan: Lijiang [Likiang], 3,500 m, 9 July 1884, P. J. M. Delavay 1142 (holotype P!; isotypes K!, P!).

Paeonia lutea Delavay ex Franch., *Bull. Soc. Bot. France* 33: 382 (1886); J. D. Hooker, *Bot. Mag.* 127: tab. 7788 (1901); Halda, *Gen. Paeonia*, 159 (2004). *Paeonia delavayi* var. *lutea* (Delavay ex Franch.) Finet & Gagnep., *Bull. Soc. Bot. France* 51: 524 (1904). TYPE: China, NW Yunnan: Eryuan Co., “Mt Hee-Chan-Men”, 25 May 1883, P. J. M. Delavay s.n. (lectotype designated by Hong *et al.* 1998a: 561, P!; isolectotype K!).

Paeonia potaninii Kom., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 7 (1921); Halda, *Gen. Paeonia*, 163 (2004). TYPE: China, W Sichuan: Yajiang “distr. Da-dsjan-lu [Ta-chien-lu] in valle fl. Jalung” [Yalong Valley], betw. Nahtschuka and Mahejdun, 19 May 1893, G. N. Potanin s.n. (holotype LE, n.v.).

Paeonia trollioides Stapf ex Stern, *J. Roy. Hort. Soc.* 56: 77 (1931). *Paeonia potaninii* var. *trollioides* (Stapf ex Stern) Stern, *J. Roy. Hort. Soc.* 68: 125 (1943); Stern, *Study Gen. Paeonia*, 50 (1946); Halda, *Gen. Paeonia*, 169 (2004). *Paeonia forrestii* var. *trollioides* (Stapf ex Stern) Saunders, *Nat. Hort. Mag.* 13: 220 (1934). TYPE: China, NW Yunnan: Deqen, Baima Shan, Mekong-Yangtse divide, open stony pastures, 3,350 m, s.d., G. Forrest 13195 (lectotype designated by Hong *et al.* 1998a: 561, E!).

Paeonia delavayi f. *superba* Lemoine, *Rev. Hort.*, 15. cum tab. s.n. (1906), as var. *lutea*. *Paeonia lutea* var. *superba* (Lemoine) Hort. ex *Gard. Chron.* n. ser. 44: 50, tab. s.n. (1908). TYPE: tab. s.n. in Lemoine, 1906!

Paeonia delavayi var. *angustiloba* Rehder & E. H. Wilson in Sargent, *Pl. Wilson* 1: 318 (1913). *Paeonia angustiloba* (Rehder & E. H. Wilson) Stapf ex Stern, *Study Gen. Paeonia*, 48 (1946), pro syn., sub *P. potaninii* Kom. TYPE: China, W Sichuan: Yajiang (W of Tachien-lu, descent to Yalong [Yalong] River), 3,000–3,600 m, Oct. 1908, E. H. Wilson 1333 (holotype A!).

Paeonia delavayi var. *atropurpurea* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 47 (1921). TYPE: not designated.

Paeonia delavayi var. *alba* Bean, *Trees Shrubs* 3: 265 (1933). *Paeonia potaninii* f. *alba* (Bean) Stern, *Study Gen. Paeonia*, 49, cum pl. (1946). TYPE: Stern’s plate cited (neotype designated by Hong *et al.* 1998a: 562).

Shrubs 0.2–1.8 m tall, glabrous throughout. Roots tuberous with tubers up to 8 cm long, 2 cm in diameter. Stems grey, 1.5 cm in diameter, shoots green, sometimes pink, with 5–9 yellow or pink scales at the base, simple but often with sterile branches in axils, occasionally branches developed and flowering. Petioles 10–22 cm long; lower 2 or 3 leaves biternate or ternate-pinnate, ovate in outline, 15–30 cm long (excl. petioles), 10–22 cm wide; leaflets 9, more-or-less decurrent, first divided into 3–11 primary segments; segments divided again mostly to near the base or halfway into 2–11 secondary segments, thus each lower leaf with (17–)40–100(–312) segments; petiolules of middle primary divisions 5–9 cm long, petiolules of lateral primary divisions 1–3 cm long, petiolules of secondary divisions much shorter; segments linear, linear-lanceolate, entire or occasionally lobed, 1.5–10 cm long, 0.5–4.5 cm wide; lobes similar to segments but shorter; segments and lobes acute at the apex. Flowers usually 2–3 on a shoot, terminal and axillary, forming a cyme, less frequently solitary and terminal, occasionally 4, more-or-less pendulous, the terminal one blooming first, the third one from the top second, the fourth from the top the third, whereas the second from the top blooms last;

Fig. 5.2A (opposite). *Paeonia delavayi* Franch.: **a**, the lower part of the shoot, showing scales at the base and a lower leaf; **b**, the upper part of the shoot, showing a cyme and flowers with petals and stamens shed; **c**, a follicle. Drawn by Miss LI Ai-Li.



2. *PAEONIA DELAVAYI*

involucrate bracts 1–5, leaf-like, the outer ones 2–4-segmented, green; sepals 2–9 in number, green outside, green but pink at the base inside, or entirely purple or purple-red, rounded or triangular-rounded, mostly caudate, rarely rounded at the apex, 1.3–3.7 cm long, 0.6–2.3 cm wide; petals 4–13, but mostly 7–11 in number, yellow, yellow with a red or purple-red spot at the base, red, dark red, or dark purple-red, sometimes white, orange, green-yellow, or yellow with red margins; stamens 25–160; filaments yellow, pink, red, or dark purple-red; anthers yellow, pink, red, or dark purple-red; disk fleshy, short, annular or short-cylindrical, 1–3 mm high, incised, green, yellowish, yellow, red or dark red; carpels 2–4, very rarely 6–8; ovaries usually green, sometimes purple; stigmas sessile, yellow-green, yellow, red or purple-red; ovules 7–17 per carpel. Follicles oblong-ovoid, 2–4 cm long, 1–1.5 cm wide, brown at maturity. Seeds 1–6 in each follicle, brown-black, oblong, c. 10 mm long, c. 8 mm in diameter. Figs 5.2A, 5.2B, 3.1d and 3.13a.

PHENOLOGY. *Paeonia delavayi* has been observed to flower from late April to mid June, with fruiting from August to October.

CHROMOSOME NUMBER. $2n = 10$ (Dark, 1936; Gong *et al.*, 1991, 1999; Li *et al.*, 1989; Xiao *et al.*, 1997; Yang & Zhu, 1989; Zhang & Sang, 1999).

HABITAT AND DISTRIBUTION. *Paeonia delavayi* was collected at altitudes from 1,900 to 4,000 m, primarily in sparse thickets or dry *Pinus* and *Quercus* woods, rarely on grassy slopes or glades of virgin *Picea* forests. The taxon is endemic to China and restricted to western Sichuan, eastern Xizang (Tibet) and Yunnan. Map 5.2.

NOTES. Plants of *Paeonia delavayi* are always dwarf shrubs. The tallest plants (ca. 1.8 m) were found in Yunshanping, Lijiang, northwestern Yunnan (D. Y. Hong *et al.* H97103), where they grew in *Picea likiangensis* (Franch.) E. Prit. forest at altitudes of c. 3,200 m. By contrast, the shortest plants (rarely reaching 1 m) were found in Ganghaizi, Lijiang (D. Y. Hong *et al.* H97095), about 20 km SE of the Yunshanping population, growing in dry, sparse *Pinus densata*–*Quercus spinosa* forest. Many dwarf individuals had woody parts underground, and only annual shoots emerged above ground. Plants of the other populations that we studied were intermediate between these two.

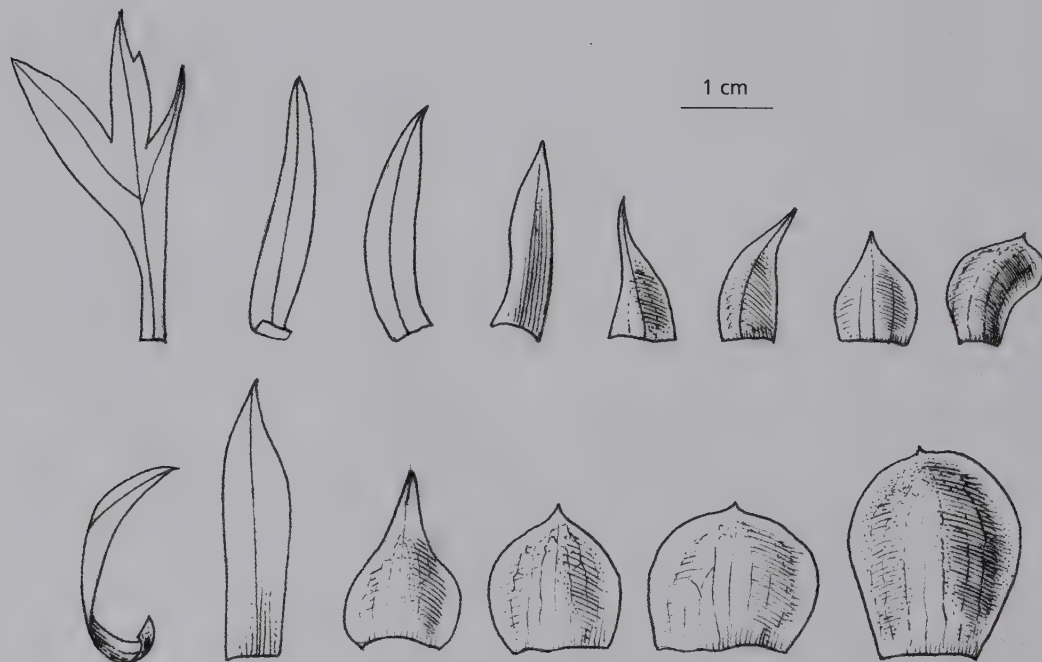
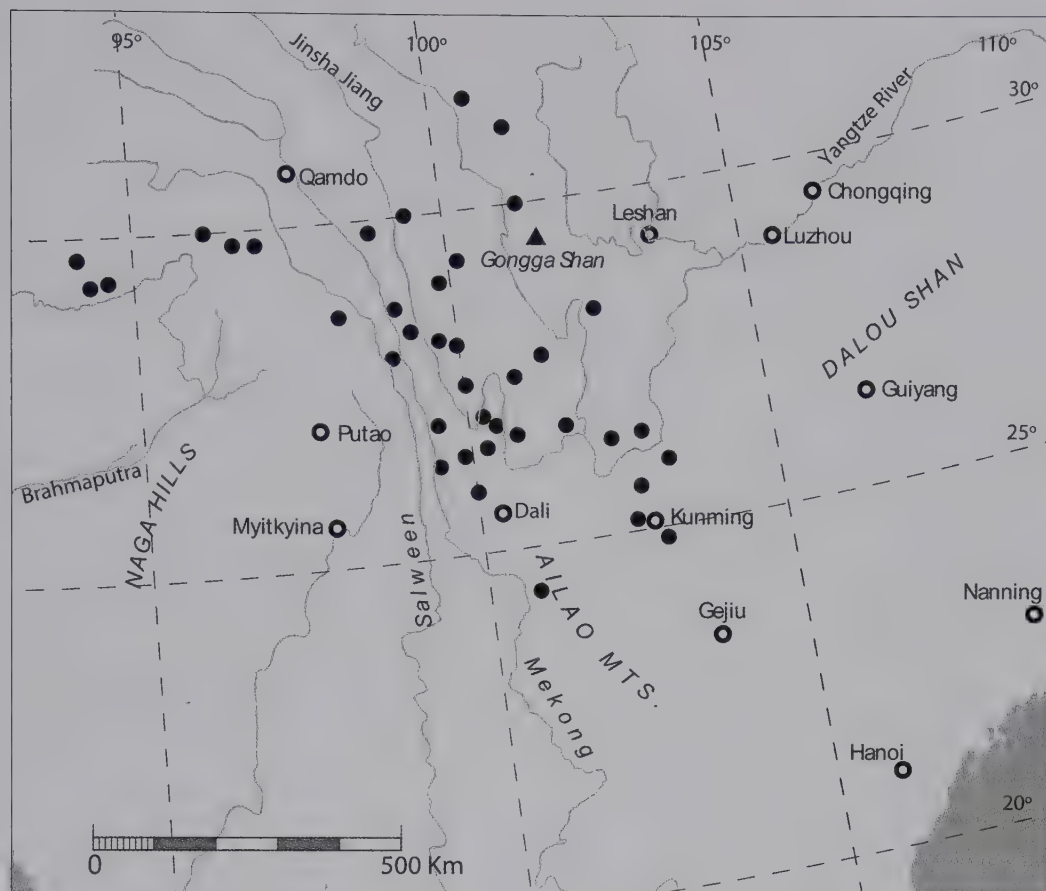


Fig. 5.2B. *Paeonia delavayi* Franch.: involucrate bracts and sepals of two flowers, based on Hong, Pan, Yu & Dai H97095 (A, CAS, K, MO, PE, US). Drawn by Mr SUN Yin-Bao.



Map 5.2. Distribution of *Paeonia delavayi* Franch.

Although the leaves of *Paeonia delavayi* are biternate or ternate-pinnate, the leaf segments are quite variable in number, length and width. The number of segments ranged widely from 17 to 312 (Hong *et al.* 1998a: fig. 3), and seemed to differ between populations. For example, segment number varied from 17 to 49 in the population D. Y. Hong *et al.* H96024 (A, K, MO, PE, US), and from 68 to 312 in the population D. Y. Hong *et al.* H95063 (A, K, MO, PE, US). However, the standard deviation of the variation in number of leaf segments (Hong *et al.* 1998a: p.556, fig. 3) shows that these two populations are just the extremes of a wide range of variation that was also observed within given populations. Taking all the populations into consideration, the number of segments varied continuously in this species. *Paeonia potaninii* was described as new by Komarov in 1921 because it was considered to have narrower leaf segments than *P. delavayi*. However, the width of leaf segments also varies greatly, ranging from 0.4 to 2.8 cm within *P. delavayi*, and from 0.76 to 1.83 cm in the population D. Y. Hong *et al.* H95070 (PE) from the type locality of *P. potaninii*. The D. Y. Hong *et al.* H95070 population falls in the middle of the overall variation ranges for leaf-segment width (Hong *et al.* 1998a: fig. 4) and length in this species. Therefore, it is evident that *P. potaninii* is similar to *P. delavayi* in this respect.

Stern (1946) distinguished *Paeonia delavayi* from its allies by the presence of a conspicuous involucre immediately below the calyx. Across the genus, however, it is difficult to distinguish clearly between involucre bracts and sepals, and there is also a gradation between leaves and involucre bracts. We designate the laminae borne some distance below the flowers as leaves, and those at the top of shoots and immediately below the calyx as involucre bracts. Involucre bracts,

so designated, have various forms, ranging from segmented and leaf-like to entire and sepal-like. The sepals have a much broader proximal part and a dark green, smaller and narrower distal part that has a mucronate or rounded apex. The total number of bracts and sepals varies greatly both within and between populations of *P. delavayi*. The population *D. Y. Hong et al.* H97103 (A, K, MO, PE, US), with dark red flowers, at Yunshanping, Lijiang, which corresponds to the type locality of *P. delavayi* (Stern 1946), indeed had the highest number of bracts and sepals (10 or 11) forming the so-called conspicuous involucre, whereas other populations observed by us had fewer bracts and sepals. However, the difference was not significant (Hong *et al.* 1998a: tab. 1). Another population *D. Y. Hong et al.* H97095 (A, K, MO, PE, US), only about 20 km from H97103, was variable in number of both bracts and sepals, and some flowers had 10 or 11 bracts and sepals (Hong *et al.* 1998a: pl. 1, vii), similar to those in the H97103 population. The same total number of bracts and sepals were found in these populations and in *D. Y. Hong et al.* H97087 (A, K, MO, PE, US), which had pure yellow or yellow petals with a dark red blotch at the base. Plate 1 in Hong *et al.* (1998a) and the remarks above demonstrate clearly that there is a continuous variation in the number of bracts and sepals, and that no correlation exists between petal colour and the total number of bracts and sepals. Therefore, *P. delavayi* cannot be separated from *P. potaninii*, *P. lutea*, *P. trollioides* and similar names.

Variation in the number and colour of floral parts extends to the sepals, which vary in colour both on a single flower and within populations (Hong *et al.*, 1998a: tab. 2). They are usually green, but sometimes dark red or purple (Hong *et al.*, 1998a: pl. 1, vii, viii; tab. 2). In addition, the sepals vary greatly in size both within and between populations, and the variation was seen as continuous (Hong *et al.*, 1998a: pl. 1, vii). Although population H97103 from Yunnan had larger sepals than other populations, the formation of a conspicuous involucre is not unique in this species as alleged by Stern (1946).

Petal colour has been much emphasised in the taxonomy of the *Paeonia delavayi* complex, used by various authors (Finet & Gagnepain, 1904; Stern, 1946; Fang, 1958) in distinguishing the yellow corollas in *P. lutea* from the dark red ones seen in *P. delavayi*. As shown by Hong and his co-workers (Hong *et al.* 1998a: tab. 2), petal colour is extremely variable between and within populations (Hong *et al.* 1998a: pl. 1, i–vi). In the populations *D. Y. Hong et al.* H97112 and H97128 from Xianggelila, Yunnan, various petal colours appeared, and a few individuals in the latter population even had white petals. On the basis of the literature and our own observations, red, dark red or dark purple-red petals occur in the northeastern portion of the distributional range, while yellow petals or yellow petals with a dark red spot at the base were found in the northeast, west, and south. Therefore, petal colour is very variable within a given region or population, showing only a weak geographical differentiation, and is not correlated with other characters. Furthermore, petal colour was extremely variable in populations such as H97112 and H97128 (Fig. 3.13a), both from northwestern Yunnan.

Unlike the floral disk of the other species of sect. *Moutan*, the disk in *Paeonia delavayi* and *P. ludlowii* is generally short and fleshy. In the populations H97112 and H97119, the disk secreted abundant nectar in some flowers, and it seems likely that this secretion made these flowers more scented. The disk, including the incised teeth, varied in height from 1 to 3 mm, and in colour from pale yellow or yellow to red, even within a single population (e.g. H97112). Therefore, these disk characters are also of little, if any, taxonomic importance in this group.

Paeonia delavayi has the widest geographical range in section *Moutan* (Map 5.2). The plants predominantly reproduce vegetatively, and cloning by stolons (Hong *et al.*, 1998a: fig. 2) was commonly seen in every population visited except for the population *D. Y. Hong et al.* H97103 (A, K, MO, PE, US) in *Picea likiangensis* forest in Yunshanping, Lijiang, Yunnan. Vegetative reproduction probably predominates in *P. delavayi*, and seedlings were very rarely found in the field. It was even more predominant at the northwestern and northern boundaries of the distributional

range. In Yajiang County, in western Sichuan, the population H95070 was found near a village, where some individuals were growing by fences and on newly stabilised debris. In this population, only about 50% of the follicles were developed and, because of insect damage, only 20% had seeds. Cloning by stolons, however, was common. Additionally, examination in the spring of 1996 of all follicles from the five populations in Xizang (Tibet) produced in 1995 found no seeds. No follicles were observed in a population (from temple ruins in the village of Xituan, Gengzhanglungba Valley, Nyingchi County, Xizang (Tibet)) that consisted of numerous individuals over an area of about 250 m². This population probably developed from individuals produced by cloning. Clonal growth by stolons was found in every population visited (Hong *et al.*, 1998a: figs 1 and 2). The roots of *P. delavayi* are always fusiformly thickened (Hong *et al.*, 1998a: fig. 2). Such roots and stolons probably make the species more adapted to open, somewhat dry and disturbed habitats, and enable the species to establish rapidly forming a new population. It may also account for the scattered distribution of the species and the large number of individuals in any given population. *Paonia delavayi* (var. *lutea*) has been listed as an endangered species in the *China Plant Red Data Book* (Feng in Fu & Jin, 1992). On the basis of its vegetative reproduction and relatively wide distribution, however, it is reasonable to conclude that this species will not become extinct so long as wanton digging is controlled (Hong *et al.*, 1998a; Gong *et al.*, 2003).

ADDITIONAL SPECIMENS EXAMINED: CHINA, SICHUAN, Batang: Zongza Township, 3,200 m, 28 July 1972, *s. coll.* 1547 (PE), by Jinsan River, Li & Xu 64-43 (CPB); East Distr., Yanrigong Township, Li & Xu 64-38 (CPB); Zangqenrong, Li & Xu 64-47 (CPB); Baisong Township, Li & Xu 64-48 (CPB). Daocheng: Dongnyi Distr., 4,000 m, 4 June 1979, *s. coll.* 275 (SM); Dongnyi, Gawa Township, Kasishe, 3,000 m, 28.07.1973, *Daocheng Division* 2397 (PE); *s. loc.* 20 Apr. 1983, *s. coll.* 09 (PE). Dawu: Mazi Township, Benglong Village, 31.1°N, 101°E, 3,000 m, 23 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95063 (A, K, MO, PE, US); Dai, Li & Tang 64-4 (CPB); Qiangning, Ochancun, Dai, Li & Tang 64-27 (CPB). Huidong, Baisanpo, Paomaping, Li, Li & Xu 64-9 (CPB). Huili, Xiacun, Heilaoling, Qiu, Zhu, Deng & Shi 66-023 (CPB). Litang, Maiwa Township, Cuowa Village, 3,155 m, 8 Aug. 2006, Y. Wang WY06078-LTP (PE) and WY06079-LTP (PE). Mianning, Jinping Shan, Z. M. Xu 64-27 (CPB); Luning Distr., Xiamatou Shan, Z. M. Xu 64-30 (CPB). Muli: Zhengxie Farm, 2,500 m, 18 May 1966, T. L. Dai & L. G. Xu DAN 66-1 (SM); mountains of Kopati, Diago and Muli, *Rock* 16157 (E); Sihe, Exi, 11 June 1979, *s. coll.* 1011 (SM); mountains between Muli and Kulu, *Rock* 24123 (E); W of Muli, Mt Mitzuga, *Rock* 16110 (E); *loc. eodem*, *Kingdon-Ward* 4043 (E); Yalientsa, in valleys, 3,000 m, 3 Sep. 1937, T. T. Yü 14147 (PE); Chaiwu, in thickets, 2,600 m, 22 May 1937, T. T. Yü 5560 (PE); Wachin, 2,900 m, 9 June 1937, T. T. Yü 6003 (PE); Luobo Township, near the ferry, 1,850 m, 14 May 1960, S. Jiang 5708 (PE); Baidiao Township, Shangjiamiwan, Li, Xu & Tang 64-17 (CPB); Boao, Li, Xu & Tang 64-11 (CPB); Boao, Shuzu Village, Li, Xu & Tang 64-19 (CPB), 64-20 (CPB); Zhuao Township, Aoxia Village, Li & Xu 64-26 (CPB); Ninglang to Edaya, *Picea* forests, 3,000–3,200 m, 27 Sep. 1983, *Qinghai-Tibet Exped.* 14845 (PE); Tangyan to Wanglang, *Pinus yunnanensis* forests, 2,900–3,000 m, 15 Sep. 1983, *Qinghai-Xizang Exped.* 14082 (PE). Xiangcheng: Qingda, L. D. Sheng 64-113 (CPB); Baiyi Township, Qingda Village, 3,175 m, 5 Aug. 2006, Y. Wang WY06074-XCP (PE) and WY06075-XCP (PE). Yajiang: Niri Township, Bajiaolou, 30°N, 101.1°E, 2,900 m, 24 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95070 (A, K, MO, PE, US); c. 5 km E of Yajiang Town, 25 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95074 (PE); *loc. eodem*, Li & Xu 64-64 (CPB). Yanbian, Yanshi Township to Jiudao Zhuling, 2,700 m, 25 June 1983, *Qinghai-Xizang Exped.* 11458 (PE). Yanyuan: 2,700–2,950 m, 12 June 1914, *Handel-Mazzetti* 2885 (WU); Dahe Township, Dashuiji, 2,800 m, 15 Aug. 2006, Y. Wang WY06087-YYP (PE); Zuosuo Township, by Lugu Lake, 27.8°N, 100.8°E, 2,900 m, 1 June 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97110 (A, CAS, K, MO, PE, US); Zuosuo Township, near Shanjiacun, Dai, Li & Tang 64-6 (CPB); Zuosuo Distr., Dai, Li & Tang 64-1 (CPB); Yantang, Dacaoxiang, Nancowan, Dai, Li & Tang 64-7 (CPB); Shangjiagou, Dai, Li & Tang 64-17 (CPB); E of Yongning (Yunnan), 27°50'N, 100°56'E, *Forrest* 20458 (E); Lumapu, 27°37'N, 9

May 1914, *Handel-Mazzetti* 2067 (E, WU). **XIZANG [TIBET]**, **Bomi**: Guxiang Township, 2,600 m, 29°55'N, 95°30'E, 3 May 1965, J. S. Ying & D. Y. Hong 39 (PE); *loc. eodem*, 10 June 1965, J. S. Ying & D. Y. Hong 214 (PE); *loc. eodem*, 2,600 m, 29.9°N, 95.5°E, 26 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96024 (A, K, MO, PE, US); *loc. eodem*, 18 May 2006, D. Y. Hong, Z. Q. Zhou & A. S. Xu H060015 (PE); between Zamu Town and Guxiang, 2,700 m, 19 July 1965, *Zhang & Lang* 379 (PE); near Zamu Town, behind Army Station, Xiao, Xia & Mi 2233 (KUN, PE); Sumzom Township, Sumzom, S of river, 3,100 m, 27 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96028 (A, K, MO, PE, US); *loc. eodem*, 19 May 2006, D. Y. Hong, Z. Q. Zhou & A. S. Xu H060016 (PE). **Markam**: Cawarong, Chaila, 3,000 m, Sep. 1935, C. W. Wang 66335 (PE); Cawarong, Dula, 3,000 m, Sep. 1935, C. W. Wang 65523 (PE); Cawalong, Songta Snow Mountain, 2,800–3,100 m, *Pinus* forests, 26 June 1982, *Qinghai-Xizang Exped.* 7673 (KUN, PE); E Himalayas, *loc. eodem*, *Kingdon-Ward* 5691 (E). **Nyingchi**: by Nyingchi Town, 29.5°N, 94.5°E, 2,950 m, 25 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96019 (A, K, MO, PE, US); Gengzhang Nongba Valley, Xituan Village, 3,200 m, 23 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96003 (A, K, MO, PE, US); Bayi Town, Jiaomugou, 29.7°N, 94.4°E, 2,950 m, 24 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96004 (A, K, MO, PE, US); between Bayi Town and Nyingchi Town, Zanba Village, 3,000 m, among shrubs with scattered trees, 17 May 2006, D. Y. Hong, Z. Q. Zhou & A. S. Xu H060012 (PE). **Zayü**: near Guyu to Cinong, *Qinghai-Xizang Exped.* 73–294 (PE); Gujing Distr., *Xizang Biol. Inst. Pl. Resources Exped.* 3895 (XZ); *loc. eodem*, 3,100 m, 14 Aug. 1980, Ni, Wang, Cidou & Cidan 1501 (PE, XZ); *loc. eodem*, *Ludlow & Sheriff* 1376 (E); Zhowagoin, 2,300 m, 26 Aug. 1961, *s. coll.* 2133 (PE); Ridong, between Xica and Dahong, 3,200 m, *Picea* forests, 27 Sep. 1982, *Qinghai-Xizang Exped.* 10746 (PE). **YUNNAN**, **Chenggong**, Mt Liangwan, summit, thickets, 2,780 m, 24 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97078 (A, CAS, K, MO, PE, US). **Dali**: Mt Pi-iou-se, above Tapin-tze, 11 June 1883, *Delavay s.n.* (syntype *P. lutea*, Pl!); Tali (Dali), Mt Che-tcho-tze, 9 May 1883, *Delavay s.n.* (syntype *P. lutea*, Pl!); *loc. eodem*, 10 Oct. 1883, *Delavay Paeonia No.7* (syntype *P. lutea*, Pl!); Mt Cangshan, Huadianba, thickets, limestones, 2,930 m, 26 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97087 (A, CAS, K, MO, PE, US), *loc. eodem*, R. C. Ching 22954 (KUN, PE); *loc. eodem*, *Sino-British Cangshan Exped.* 0684 (E, KUN); *loc. eodem*, Xiaohuadianba, Q. Ling 7708 (KUN); *loc. eodem*, *McLaren* 55 (E); E flank of the Cangshan range, *Forrest* 4352 (E), 6787 (E), 30998 (E); Mt Yinglefong, summit, June 1941, H. C. Wang 896 (PE). **Dêqên**: *s. loc.*, 3,500 m, 19 June 1960, *Kunming Inst. Bot.* 9463 (KUN, PE); Benzilan, 3 km W of Susong Village, 2,900–3,300 m, 4 June 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97119 (A, CAS, K, MO, PE, US); Cizhong to Yongzi, by the Lancang River, 2,000 m, Jul. 1940, K. M. Feng 5765 (KUN, PE); Atuntze, Wuyen, 2,400 m, 20 May 1937, T. T. Yü 8381 (PE); Yunling, 3,000 m, 11 June 1960, *Nanshui Beidiao Exped.* 9194 (KUN, PE); E flank of Baima Shan, Benzilan, *Qinghai-Xizang Exped.* 11795 (KUN, PE); Benzilan, Yonglobu (Forest Farm), 3,200 m, 6 July 1981, *Qinghai-Xizang Exped.* 1878 (KUN, PE); Benzilan, Dongzuling, 8 Aug. 1981, *Qinghai-Xizang Exped.* 2209 (KUN, PE); *loc. eodem*, 2,700 m, Sep. 1935, C. W. Wang 70211 (KUN, PE); Baima Shan, *Rock* 22821 (E); 28°28'N, 3,300 m, 1914, A. K. Gebauer *s.n.* (WU). **Dongchuan**: Jinniu, D. C. Liu 0447 (CPB); Mt Lo Shivel, *McLaren* V2 (E); Yingming, 2800–3000 m, 8 May 1985, S. B. Lan 392 (PE). **Gongshan**: Suroula, 3,500 m, Sep. 1935, C. W. Wang 66617 (KUN, PE); Mekong–Salwin divide, 28°12'N, *Forrest* 16339 (E), *Forrest* 16527 (E). **Heqing**: Laugkong–Hoching divide, 26°16'N, *Forrest* 10062 (E); Baiya, Sanxi, 3,000 m, Sep. 1929, R. C. Ching 24365 (KUN, PE); Songgui, Mt Maer, 3,500 m, 29 May 1929, R. C. Ching 24191 (KUN, PE). **Jianchuan**, Xinsheng Township, Huajiaping, P. Y. Mao 236 (KUN). **Jingdong**, Tehching, Muyung, in ravine, 2,800 m, 26 Sep. 1937, T. T. Yü 10470 (PE). **Kunming**: Shanqing Temple, 2,200 m, 20 May 1946, T. N. Liou 01 6149 (PE); Shanqing Temple to Shitoushan, 15 July 1946, T. N. Liou 20677 (KUN, PE); West Hill, 2,000 m, 23 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97077 (A, CAS, K, MO, PE, US); *loc. eodem*, 3,200 m, 25 Oct. 1953, B. Y. Qiu 55307 (PE), 51019 (KUN) and B. Y. Qiu 57101 (KUN); *loc. eodem*, 2,100–2,200 m, 17 May 1988, D. Y. Hong PB88007 (PE); Seventh Distr., Shungxiao Township, B. Y. Qiu 51880

(KUN); Longquan Distr., Heping Township, S. K. Wu 8 (KUN). **Lanping**, No. 104 Forest Farm, West Hill of Xiaoyanjing, 3,100 m, coniferous forests, 29 June 1981, *Hengduan Mt Exped.* 908 (PE). **Lijiang**: s. loc. 2,300 m, June 1935, C. W. Wang 70489 (PE); s. loc. 2,800 m, July 1935, C. W. Wang 70907 (PE); Yangtze-Yungning divide, 27°40'N, 3,050 m, June 1914, G. Forrest 12565 (syntype *P. trollioides*, El). Yulong Snow Range, Ganghaizi, 2,940 m, *Pinus-Quercus* forests, 30 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97095 (A, CAS, K, MO, PE, US); loc. eodem, 2,985 m, *Pinus-Quercus* forests, 7 June 1981, *Qinghai-Xizang Exped.* 201 (PE); loc. eodem, *Edinburgh Bot. Gard. Exped.* 85-6 (E, KUN); loc. eodem, 29 May 1939, R. C. Ching 20438 (KUN, PE); loc. eodem, Z. W. Lu 1002 (KUN); loc. eodem, *Kingdon-Ward* 238 (E); Yulong Snow Range, Muzhugou to Ganghaizi, X. Zhou 1030 (KUN), Qingmugou to Ganghaizi, *Lijiang Bot. Gard.* 100486 (KUN); Yulong Snow Range, Yunnan Univ. Biol. Dept. *Vegetation Exped.* 233 (KUN), R. C. Ching 30987 (KUN, PE); Yulong Snow Range, Yuhu, Xuesong Village, Mt Beibazi, R. C. Ching 30175 (KUN, PE), K. M. Feng 21245 (KUN), E of the village, 4 May 1939, R. C. Ching 30071 (KUN, PE); near Yuhu, Ameidiruo, K. M. Feng 22229 (KUN); Yulong Snow Range, Wutoudi, K. M. Feng 23029 (KUN, PE); below Yulong Snow Range, Baishui, 2,850 m, 30 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97102 (A, CAS, K, MO, PE, US); Yulong Snow Range, Yunshanping, *Picea* forests, 3,200 m, 30 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97103 (A, CAS, K, MO, PE, US); Yulong Snow Range, Mahuangba to Wutoudi, 3,400–3,800 m, 18 Oct. 1964, Z. H. Yang & Y. C. Cai 101777 (PE); Yulong Snow Range, Jiuzihai to Yulong Snow Range, Heishui, J. S. Yang 4157 (KUN); Heishui River, left slope, 2,900 m, 10 May 1962, *Lijiang Bot. Gard.* 100026 (KUN); Yulong Snow Range, Sandaowan, *Picea* forests, 3 Aug. 1981, *Hengduan Mt Exped.* 02490 (PE); Yulong Snow Range, Mt Gyina Loko, *Rock* 24984 (E); E flank of Yulong Snow Range, 3,050–3,660 m, June 1910, *Forrest* 5716 (E); Xuesong Village, 3,400 m, 7 May 1937, T. T. Yü 15016 (E, PE); Mt Wenbi, 2,800 m, 12 Apr. 1937, T. T. Yü 8107 (KUN, PE); N Lijiang, Hongshiyuan, between Shikoo and Moschi, 26 May 1939, R. C. Ching 20595 (KUN, PE); Shapingze, 2,700 m, 29 Apr. 1937, T. T. Yü 5160 (KUN, PE); loc. eodem, 2,700 m, 29 Apr. 1937, T. T. Yü 5163 (KUN, PE); Sixth Distr., X. L. Wang s.n. (CPB); Zili, by the river, R. C. Ching 22192 (KUN, PE); S of Lijiang, Sungkwe Pass between Lijiang and Heqing, *Rock* 25179 (E); 22 km from Lijiang to Yongsheng, 26.8°N, 100.4°E, 2,640 m, thickets by highway, 31 May 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97108 (PE). **Luquan**: Xinming Township, Laoyingya, 3,100 m, 22 May 1952, P. Y. Mao 939 (KUN); Emao Township, Mt Dangan, 2,800 m, 1 Nov. 1952, P. Y. Mao 01565 (KUN, PE). **Ninglang**: Gouzuandong, J. S. Yang 4123 (KUN); Yongning, Geao Pass, J. S. Yang 4130 (KUN); hills around Yongning, *Forrest* 12503 (E); Yongning, Shize Shan, 2,700 m, 9 May 1937, T. T. Yü 5336 (PE); by the Lugu Lake, Luoshui Village, 2,900 m, limestone, *Pinus-Quercus* forests, 1 June 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97111 (PE); by the Lugu Lake, Yougu, 2,730 m, 13 Aug. 2006, Y. Wang WY06082-NLP (PE); Yongning, Wenquan Township, near Wenquan, Dai, Li & Tang 64-2 (CPB), Liujiashu, Dai, Li & Tang 64-3 (CPB); loc. eodem, Dai, Li & Tang 64-4 (CPB); E of the Yangtze bend, 27°35'N, 100°45'E, *Kingdon-Ward* 3981 (E); loc. eodem, McLaren 5 (E), 89 (E), *Kingdon-Ward* 5055 (E). **Weixi**: Pengtselan, 1,950 m, 10 May 1937, T. T. Yü 8194 (PE); Yezhi, by Lancang (Mekong) River, K. M. Feng 4220 (KUN, PE); Yezhi, 3,300 m, Aug. 1935, C. W. Wang 68199 (PE); Yangtze-Mekong divide, 29°45'N, 3,300–3,400 m, *Handel-Mazzetti* 8868 (E, WU); Pantiange Distr., Wucun Village, D. Y. Chen s.n. (CPB). **Yongsheng**, Shunzhou Distr., Shisanzuo, J. S. Yang 4402 (CPB). **Zhongdian (Xianggelila)**: 3,225 m, 24 June 1915, *Handel-Mazzetti* 6969 (WU); 23 km NW of Zhongdian Town, Hala Village, 3,200–3,300 m, 3 June 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97112 (A, CAS, K, MO, PE, US); 45 km N of Zhongdian Town, Gezan Township, 3,040 m, sparse thickets, 6 June 1997, D. Y. Hong, K. Y. Pan, H. Yu & B. Dai H97128 (A, CAS, K, MO, PE, US); Gezan Township, Wungshang Village, 2,980 m, 1 Aug. 2006, Y. Wang WY06066-XGLLP (PE) and WY06067-XGLLP (PE); Baimangxue Shan, E slope, 3,400–3,600 m, 17 Aug. 1981, *Hengduan Mt Exped.* 3180 (PE); Wucun, Gongbi, K. M. Feng 23561 (KUN, PE); Zhongdian to Annachang, K. M. Feng 938 (KUN, PE); Tuguancun to Haba Xuemenkang, *Zhongdian Exped.* 63-2389 (KUN, PE); Haba, 3,440 m, 25 Sep.

1937, T. T. Yü 13581 (PE); *loc. eodem*, 3,000 m, 4 Sep. 1937, T. T. Yü 13500 (PE); Haba, Longwang Binsanba, *Zhongdian Exped.* 63-2738 (KUN, PE); Huangdong, Reshuitang, *Zhongdian Exped.* 63-2597 (KUN, PE); Qiaotou to Xiaozhongdian, near Hongtuxiao, 13 May 1939, K. M. Feng 885 (KUN, PE); Haba to Xiaozhongdian, 24 June 1939, K. M. Feng 1387 (KUN, PE); Baidi, 3,200 m, 26 May 1937, T. T. Yü 11389 (KUN, PE); *loc. eodem*, 3,200 m, 20 Nov. 1937, T. T. Yü 14915 (PE); Tuguancun, *Zhongdian Exped.* 63-2375 (KUN, PE); Haba, Annazai, *Zhongdian Exped.* 63-2647 (KUN, PE); Haba, near Longwanbin, 3,200 m, 29 Aug. 1962, *Zhongdian Exped.* 1634 (KUN, PE); Naixi Township, Tangdoi Village, 3,320 m, 31 July 2006, Y. Wang WY06062-XGLLP (PE), WY06063-XGLLP (PE) and WY06064-XGLLP (PE); SE of Zhongdian Town, Jiuluo, 3,600 m, 16 Aug. 1962, *Zhongdian Exped.* 929 (KUN, PE); *loc. eodem*, 27°50'N, Forrest 15162 (E); Haba Shan, N of the Yangtze loop, Rock 24758 (E); *loc. eodem*, 27°30'N, Forrest 12561 (E); Chihren, 2,500 m, 12 May 1937, T. T. Yü 11247 (E, PE); N of Zhongdian Town, Tonwa Territory, Rock 24717 (E); Baoshan Village, Xiaguanfang, forests, 2,870 m, 14 July 1997, Y. B. Luo 9723 (PE).

I – Ib. *PAEONIA* sect. *MOUTAN* subsect. *VAGINATAE* Stern (species 3–8)

3. *Paeonia decomposita* Hand.-Mazz., *Acta Horti Gothob.* 13: 39 (1939); Hong, Pan & Pei, *Taxon* 45(1): 68 (1996); Hong, *Kew Bull.* 52(4): 957 (1997); Haw, *The New Plantsman* 8: 165 (2001). TYPE: China, NW Sichuan: “Sikang: Chosodjo, ad radices rupium, c. 3,000 m, 18. x. 1922” H. Smith 4641 (holotype UPS!; photo PE!).

Paeonia szechuanica W. P. Fang, *Acta Phytotax. Sin.* 7: 315, pl. 61-1 (1958); Pan, *Fl. Reip. Pop. Sin.* 27: 45, pl. 4 (1979); Hong in Fu & Jin, *China Plant Red Data Book* 1: 536 (1992). TYPE: China, NW Sichuan: Barkam, “Ma-erh-kang hsien, lower O-mu-li-ting-ku, alt. 2,650 m, in thickets”, 29 Apr. 1957, X. Li (H. Lee) 70316 (holotype SZ!; isotype PE!); Barkam, 3,100 m, 10 June 1957, X. Li 71387 (paratype PE!, SZ!); *loc. eodem*, 2,700 m, 11 May 1957, X. Li 70647 (paratype PE!, SZ!); *loc. eodem*, 2,750 m, 19 May 1957, X. Li 71071 (paratype PE!, SZ!); Barkam, Zonggang, 2,650 m, 11 May 1957, X. Li 70591 (paratype PE!, SZ!); *loc. eodem*, 2,640 m, 18 May 1957, X. Li 70701 (paratype PE!, SZ!).

Shrubs to 1.8 m tall, glabrous throughout. Stems grey-black, peeling off in flakes, up to 2 cm in diameter; young shoots purple-red. Lower leaves mostly triternate-pinnate, ternate-bipinnate, biternate-bipinnate, rarely biternate-pinnate, or quartiternate-pinnate, with 29–63 leaflets; leaflets not decurrent; terminal leaflets elliptic to orbicular, 2.5–6.5 cm long, 1.2–4.5 cm wide, 3-partite to the base or 3-fid, terminal lobes 3-lobed; lateral leaflets elliptic to orbicular, 1.8–5.5 cm long, 0.6–4.5 cm wide, 3-lobed or coarsely toothed. Flowers solitary, terminal, 10–15 cm wide; involucre bracts 2–5, mostly 2 or 3 in number, unequal, linear-lanceolate; sepals 3–5, green, broadly obovate, 2–3 cm long, 1.5–2.0 cm wide, all caudate at the apex; petals 9–12, rose, obovate, 4–7 cm long, 3–5 cm wide, usually 2-lobed and irregularly incised or toothed at the apex; disk leathery, enveloping carpels by half to two-thirds at anthesis, white or yellowish, with triangular teeth; carpels 2–5, green or purple; styles 1–2.5 mm long; stigmas red. Follicles black-brown when mature, ellipsoid, 2–4 cm long, 1.3–1.7 cm in diameter. Seeds black, glossy, broadly ellipsoid or globose, 8–10 mm long, 6–8 mm in diameter. Figs 5.3A, 5.3B.

PHENOLOGY. *Paeonia decomposita* was found in flower in April and May, and in fruit in August.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, 1988; Hong, 1997b).

HABITAT AND DISTRIBUTION. *Paeonia decomposita* occurred in sparse *Cupressus chengiana* forests, young and secondary deciduous broad-leaved forests, and thickets, at an altitude of 1,700–3,100 m. The taxon is endemic to northwestern Sichuan in China, found only in the Dadu River Valley and the Minjiang River Valley.

The species was listed as endangered by Hong (1992), when known from only three localities. Our recent extensive field work shows, however, that it is neither endangered nor rare, although it is restricted in distribution. Threats to this species and its two subspecies are the collection of root and bark for medicine, and habitat destruction. Map 5.3.

NOTES. The species is glabrous throughout and unique among woody peonies in its lower leaves being 3 or rarely 4 times compound, i.e. 3- or 4-ternate, with 29–63 leaflets, and in the disk leathery, enveloping half to two-thirds of the carpels at anthesis (neither completely enveloping them as in the *P. suffruticosa* complex nor enveloped only at the base as in *P. delavayi* and *P. ludlowii*). No cloning has yet been observed for this species.

Key to subspecies of *Paeonia decomposita*

- 1a. Carpels nearly always 5; terminal leaflets with length/width ratio (1.5–)1.7– 2.7(–3.3); terminal lobes with length/width ratio (1.6–)2.4–3.7(–4.3) 3a. subsp. *decomposita*
- 1b. Carpels 2–5, mostly 3 or 4; terminal leaflets with length/width ratio (1.0–)1.2–1.8(–2.2); terminal lobes with length/width ratio (1.0–)1.3–2.4(– 3.0) 3b. subsp. *rotundiloba*

3a. *Paeonia decomposita* subsp. *decomposita*

Leaflets lanceolate to ovate; lobes also narrow, terminal lobes acuminate at the apex, and carpels nearly always 5 in number.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, 1988).

HABITAT AND DISTRIBUTION. The autonymic subspecies of *Paeonia decomposita* was observed to grow in thickets, young secondary forests or sparse coniferous forests with *Cotoneaster soongaricus* (Regel) Popov, *Rosa willmottiae* Hemsl., *Berberis polyantha* Hemsl., and *Cupressus chengiana* S. Y. Hu, as well as species of *Lespedeza*, *Rhamnus* L. and *Quercus* L., on cliffs and rocks at altitudes from 2,050 to 3,100 m. This subspecies is confined to the Dadu River Valley of northwestern Sichuan in China. Map 5.3.

ADDITIONAL SPECIMENS EXAMINED. CHINA, NW SICHUAN, Barkam: Barkam Town, 2750 m, 15 May 1985, D. Y. Hong & X. Y. Zhu PB85045 (PE); 2650 m, 8–16 Aug. 1991, Y. L. Pei 9114 (PE); 2700 m, 19 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95035 (A, K, MO, PE, US); Adi Village, 2700 m, edges of *Betula*–*Picea* forests, 13 May 2006, D. Y. Hong & Z. Q. Zhou H06010 (PE); Zonggang Township, 2620 m, 13 May 1985, D. Y. Hong & X. Y. Zhu PB85025 (PE); *loc. eodem*, 13 May 2006, D. Y. Hong & Z. Q. Zhou H06008 (PE); *loc. eodem*, 2550 m, 20 June 2006, Y. Wang WY06051-MEKP (PE). **Danba:** Donggu Township, at mouth of Sancong Valley, 2,350 m, 22 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95050 (A, K, MO, PE, US). **Jinchuan:** between Hongqi Bridge and Guangyin Bridge, 2,400–2,500 m, 20 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95036 (A, K, MO, PE, US); Sa'er Township, 2,300 m, 8–16 Aug. 1991, Y. L. Pei 9113 (PE); Zengda Township, Zengda Village, 2,200–2,350 m, 21 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95037 (A, K, MO, PE, US); Ma'erbang, Liujiagou, 13 May 1958, X. Li 77098 (PE, SZ). **Kangding:** Dahegou Village, 2,050 m, 26 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95080 (A, K, MO, PE, US).

3b. *Paeonia decomposita* subsp. *rotundiloba* D. Y. Hong, *Kew Bull.*, 52(4): 961, fig. 1a. 1997; Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 130 (2001); Haw, *The New Plantsman* 8: 166 (2001). TYPE: China, NW Sichuan: Lixian, 31.4°N, 103°E, 2,200 m, *Cupressus chengiana* forests, 18 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95033 (holotype PE!; isotypes A!, K! MO!, US!).

CHROMOSOME NUMBER. $2n = 10$ (Hong, 1997b).





Map 5.3. Distribution of *Paeonia decomposita* Hand.-Mazz.: black circles = subsp. *decomposita*; stars = subsp. *rotundiloba*.

HABITAT AND DISTRIBUTION. Subspecies *rotundiloba* in *Paeonia decomposita* occurred in well-developed thickets, young secondary forests or sparse *Cupressus chengiana* forests, often associated with *Rosa multibracteata* Hemsl. & E. H. Wilson, *Cotoneaster soongaricus* Popov, *Ostryopsis davidiana* Decne, *Cotinus coggygria* Scop., as well as species of *Quercus* L., *Rhamnus* L., *Ribes* L. and *Spiraea* L., etc. The subspecies was usually found on rocks at altitudes of 1,700–2,700 m. It is restricted to Minjiang Valley of northwestern Sichuan, isolated from the typical subspecies by the Qionglai Range, which reaches over 4,000 m in altitude. Map 5.3.

NOTES. This subspecies differs from the typical one in having much wider leaflets that are ovate-orbicular, lobes also wider, with terminal ones acute at the apex, and carpels mostly three to four, less frequently two or five in number.

ADDITIONAL SPECIMENS EXAMINED. **CHINA, SICHUAN, Heishui:** Sergu Township, Sergu Village, 2,300 m, 16 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95017 (A, K, MO, PE, US); 28 Sep. 1964, J. D. Li & Z. M. Xu 64-100 (CPB, PE). **Lixian:** near the city, above Daping, 1,900 m, 18 Aug.

Fig. 5.3A (opposite). *Paeonia decomposita* Hand.-Mazz.: **a**, the lower part of the shoot with a lower leaf (binate-bipinnate); **b**, the upper part of the shoot and a flower with petals and stamens shed, showing five carpels and the incised disk; **c**, a carpel; **d**, a follicle. Drawn by Miss LI Ai-Li.

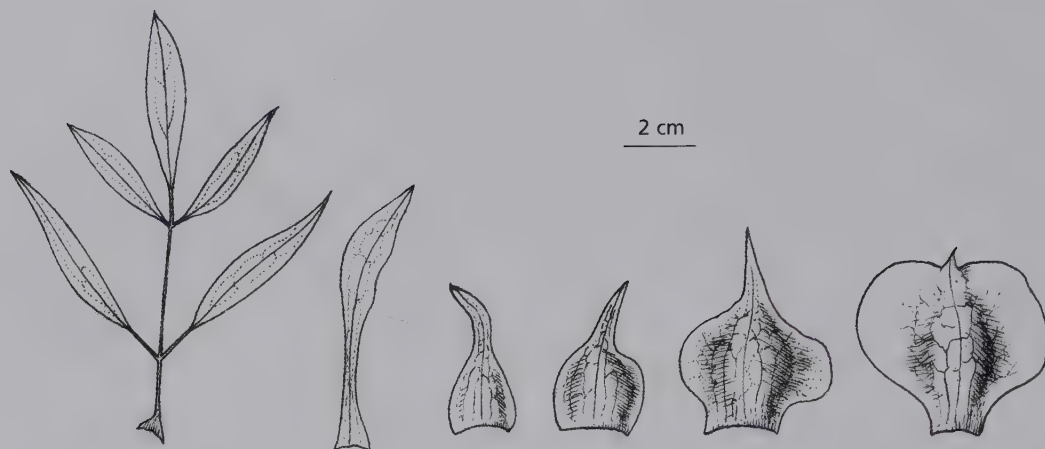


Fig. 5.3B. *Paeonia decomposita* Hand.-Mazz. subsp. *decomposita*: involucrate bracts and sepal, based on D. Y. Hong & X. Y. Zhu PB85045 (PE). Drawn by Mr SUN Yin-Bao.

1995, D. Y. Hong, Y. B. Luo & Y. H. He H95031 (K, PE); Potou Township, Yikeyin Village, 1,850 m, 18 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95032 (A, K, MO, PE, US); Potou Township, Sinan Village, 2,280 m, 25 July 2006, Y. Wang WY06060-LXP (PE) and WY06061-LXP (PE); Weiguangou (valley), 2,500 m, 9 Sep. 1964, T. L. Dai, R. H. Li & G. H. Tang 64-10 (PE). **Maoxian**: 2,200–2,300 m, 5 May 1989, J. Z. Qiu 8901 (PE); 2,100 m, Aug. 1991, Y. L. Pei 9110 (PE); Nanxin Township, behind Wenzhen Village, 1,900 m, 17 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95030 (PE); Nanxin Township, Mianshegou, 1,705 m, 24 July 2006, Y. Wang WY06056-MXP (PE) and WY06058-MXP (PE); Dagou, 1,750 m, 15 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95015 (A, K, MO, PE, US); 20 May 1996, K. Y. Pan & Y. H. He 96002 (A, K, MO, PE, US); near the city, 2,200 m, 20 May 1996, K. Y. Pan & Y. H. He 96003 (A, K, MO, PE, US); Huangcaohe, 1,700 m, 8 Oct. 1964, T. L. Dai, R. H. Li & G. H. Tang 64-33 (PE). **Songpan**, Zhenjianguan, 2,400 m, 12 Aug. 1996, Y. H. He 96055 (PE). **Wenchuan**: 1,960 m, Aug. 1991, Y. L. Pei 9111 (PE); Longxi Township, 2,700 m, 30 Sep. 1964, T. L. Dai, R. H. Li & G. H. Tang 64-7 (PE).

4. *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong, *Acta Phytotax. Sin.* 37(7): 539 (1998); Haw, *The New Plantsman* 8: 164 (2001). Basionym: *Paeonia suffruticosa* Andrews subsp. *rockii* S. G. Haw & Lauener, *Edinburgh J. Bot.* 47(3): 279, fig. 1a (1990). *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li, *Bull. Bot. Res. Harbin* 12(3): 227, fig. 4 (1992), nom. inval. TYPE: China, Kansu [Gansu]: “probably near Wutu (Wudu), (Farrer’s Chieh Jo)”, [probably Apr. 1914], R. J. Farrer no 8(?) (holotype E!; photo PE!).

Paeonia papaveracea auct. non Andrews: Anonymous, *Icon. Cormophyt. Sin.* 1: 652, fig. 1303 (1972). *P. suffruticosa* Andrews var. *papaveracea* auct. non Andrews: Pan, *Fl. Reip. Pop. Sin.* 27: 45, pl. 3 (1979). *P. suffruticosa* auct. non Andrews: Stern, *Study Gen. Paeonia*, 40 (1946), pro parte, excl. var. *spontanea*; Fang, *Acta Phytotax. Sin.* 7(4): 313 (1958), pro parte, excl. var. *spontanea*.

Shrubs to 1.8 m tall. Roots cylindrical, attenuate downwards. Turions absent. Stems grey or grey-brown, peeling off in flakes. Lower leaves ternate-pinnate, ternate-bipinnate or biternate-pinnate, with 17–33 leaflets; leaflets lanceolate to ovate-lanceolate and mostly entire, or ovate to ovate-orbicular and mostly lobed, 2–11 cm long, 1.5–4.5 cm wide, glabrous above, villose along veins beneath, truncate to cuneate at the base, acute or acuminate at the apex. Flowers solitary, terminal; involucrate bracts 3–4 in number, leaf-like; sepals 4–7 in number, green, ovate-lanceolate, ovate-orbicular or orbicular, all caudate at the apex, 3–4 cm long, 3–4.5 cm wide; petals 8–13 in number, obovate, entire or irregularly incised, white or rarely red, with a large and dark

purple blotch at the base, 5–9 cm long, 4–7 cm wide; filaments yellow; anthers yellow; disk entirely enveloping carpels at anthesis, pale yellow, leathery, dentate or lobed at the apex; carpels 5, rarely 6, densely tomentose; styles 0.5–2 mm long, tomentose; stigmas pale yellow. Follicles oblong, densely yellow tomentose, c. 3 cm long. Figs 5.4A, 5.4B, 5.4C.

HABITATS. In deciduous broad-leaved forests, forest margins or thickets, on shady slopes of limestone areas, at altitudes from 850 to 2,800 m.

DISTRIBUTION. Confined to S Gansu, W Henan, W Hubei, S Ningxia, Shaanxi, and N Sichuan. Map 5.4.

DIAGNOSTIC CHARACTERS. This species is characterised by having lower leaves ternate-pinnate, biternate-pinnate or ternate-bipinnate; leaflets usually number 19–33, very rarely fewer than 19, the filaments are yellow, with the disk yellowish white and the stigmas yellow, as well as the highly distinctive petals of white, rarely red, with a large dark purple blotch at the base. Thus, this species is clearly distinguished from the remaining four in the *Paeonia suffruticosa* complex: *P. jishanensis*, *P. ostii*, *P. qiui* and *P. cathayana*. Its petals are the largest in the whole genus, reaching to 9 × 7 cm in length and width, respectively.

Two allopatric subspecies can be readily recognised by the key couplet below:

- 1a. Leaflets lanceolate to ovate-lanceolate, all or mostly entire 4a. subsp. *rockii*
- 1b. Leaflets ovate to ovate-orbicular, all or mostly lobed 4b. subsp. *atava*

4a. *Paeonia rockii* subsp. *rockii*

Paeonia rockii subsp. *linyanshanii* (Halda) T. Hong & G. L. Osti ex X. Y. Zhu & T. Hong, *Taxon* 54(3): 807 (2005). Basionym: *Paeonia suffruticosa* Andrews var. *linyanshanii* Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 30 (1997), in subsp. *rockii* S. G. Haw & Lauener; Halda, *Gen. Paeonia*, 151 (2004). *Paeonia rockii* subsp. *linyanshanii* T. Hong & G. L. Osti, *Bull. Bot. Res. Harbin* 14(3): 237, figs 1 and 2 (1994), nom. inval. TYPE: China. Gansu: Wenxian, 1,200–1,400 m, 17 May 1992, Zhang Qi-rong 19920517 (neotype designated by Zhu & T. Hong, 2005: 807, PE!).

Paeonia linyanshanii (S. G. Haw & Lauener) B. A. Shen, *Lishizhen Medic. Mater. Med. Res.* 12(4): 331 (2001), nom. illeg. (no any combination of *linyanshanii* and S. G. Haw & Lauener).

Paeonia rockii subsp. *lanceolata* Y. L. Pei & D. Y. Hong in Y. L. Pei: *Studies on the Paeonia suffruticosa Andr. Complex*. Ph.D. thesis, 26 (1993), nom. inval.

PHENOLOGY. Flowering from late April to May; fruiting from late July to August.

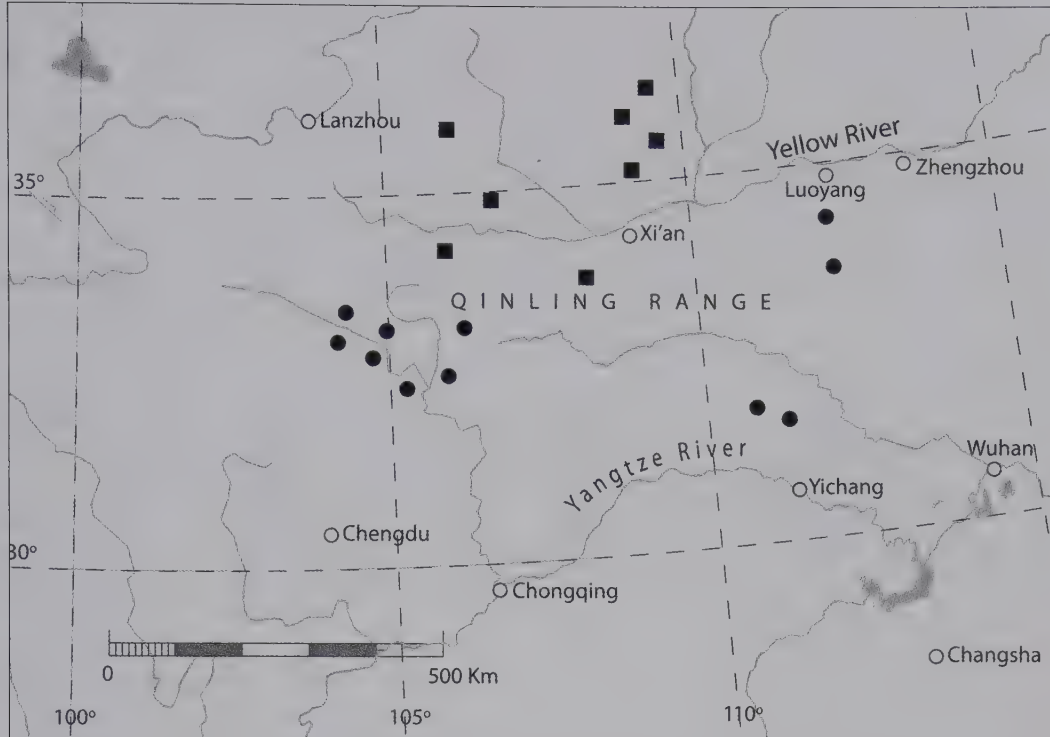
CHROMOSOME NUMBER. 2n = 10. The present work represents the first report in the literature and is vouchered: China, Shennongjia, T. Chen & L. M. Ma PB86011 (PE).

HABITATS. Usually growing in deciduous forests, usually in limestone areas at an altitude of 850–2,800 m.

DISTRIBUTION. Relatively widely distributed in five provinces: SE Gansu, W Henan, W Hubei, S Shaanxi and N Sichuan. Map 5.4.

ADDITIONAL SPECIMENS EXAMINED. CHINA, GANSU, Huixian: Mayanhe, 850 m, in forests, 10 July 1997, D. L. 97076 (PE); Yinxi Township, Mt Hailongshan, 1,373 m, 2 Sep. 2006, Y. Wang WY06096-HXP (PE). **Tianshui:** Lizi Township, Lizi Village, 1,700 m, 4 May 1991, Y. L. Pei 9150 (PE); *loc. eodem*, 24 May 2006, Y. Wang WY06031-TSP (PE) and WY06033-TSP (PE); Zhilong Shan, Shihuigou, 14 May 1956, *Yellow River Exped.* 3698 (PE). **Wenxian**, *s. loc.*, Y. L. Pei 9115 (PE). **Wudu**, Lanshan, 2,500 m, 21 June 1930, K. S. Hao 501 (in sched. *P. kansuensis* W. T. Wang & S. H. Wang, PE!). **Zhugqu:** Taozhou Forest Farm, 2,800 m, *Pinus armendi* forests, 22 May 1959, S. Jiang & C. L. Jin 00423 (PE); *loc. eodem*, Y. L. Pei 9116 (PE). **HENAN, Neixiang:** Baotiaman Nature Reserve, Muzhuliu, Mudanduo, 1,100 m, in secondary deciduous forests, 30





Map 5.4. Distribution of *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong. Circles = subsp. *rockii*; squares = subsp. *atava*.

Apr. 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97015 (PE, MO); *loc. eodem*, Muzhuliu Village, in cultivation, 30 Apr. 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97016 (A, CAS, K, MO, PE, US). **Songxian:** Muzhijie Township, Mt Yangshan, Yangjiaohao, W slope, limestones, in *Ulmus* forest, 1,450 m, 2 May 1994, D. Y. Hong & Y. Z. Ye 94003 (PE); *loc. eodem* Daxigou, under limestone rocks, 2 May 1994, S. Y. Wang & Y. Z. Wang 94002 (PE); Xisangou, 1,080 m, 7 May 1994, H. Y. Jia 023 (PE) and 024 (PE). **HUBEI, Baokang:** Houping Township, Hongjiayuan Village, in front of Mr Su Yuan-zhi's house, in cultivation, 2 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97024 (PE); Houping Township, Zhanjiapo Village, in deciduous forests, on limestone rocks, 1,360 m, 5 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97051 (A, CAS, K, MO, PE, US). **Shennongjia:** Songbai, 1,900 m, 6 May 1988, J. Z. Qiu PB88027 (PE), *loc. eodem*, 2,010 m, 6 May 1988, J. Z. Qiu PB88022 (PE) and PB88028 (PE); *loc. eodem*, 2,000 m, 6 May 1988, J. Z. Qiu PB88030 (PE); *loc. eodem* 2,100 m, 6 May 1988, J. Z. Qiu PB88031 (PE) and PB88032 (PE); *loc. eodem*, 1,900 m, 20 May 1988, J. Z. Qiu PB88033 (PE); *loc. eodem*, August 2004, D. Y. Hong & Z. Q. Zhou H04042 (PE); *loc. eodem*, 1,600 m, 20 May 1988, J. Z. Qiu PB88035 (PE); *loc. eodem*, 2,200 m, 19 May 1986, T. Chen & L. M. Ma PB86016 (PE); *loc. eodem*, 2,200 m, 19 May 1986, T. Chen & L. M. Ma PB86017 (PE); Songbai, Shantunya, May 1988, J. Z. Qiu PB88601 (PE); Songbai, shady slope, in forests, 1,400–1,800 m, 18 May 1986, T. Chen & L. M. Ma PB86008 (PE), PB86009 (PE), PB86010 (PE) and PB86011 (PE). **SHAANXI, Lueyang:**

Fig. 5.4A (opposite). *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong subsp. *rockii*: **a**, the lower part of the shoot; **b**, the upper part of the shoot and a flower showing the lacerated disk; **c**, a lower leaf; **d**, a follicle; **e**, the lower surface of a leaf, showing villose hairs. Drawn by Miss LI Ai-Li.

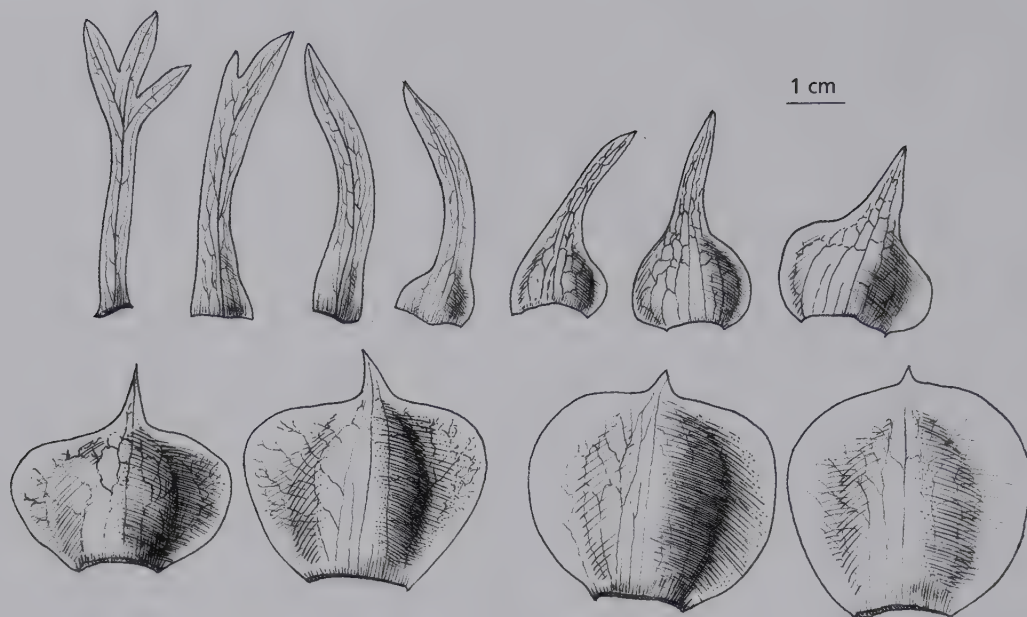


Fig. 5.4B. *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong subsp. *rockii*: involucre bracts and sepals, based on D. Y. Hong & Z. Q. Zhou H04042 (PE). Drawn by Mr SUN Yin-Bao.

Baishuijiang Township, Siping Village, Baiyanggou, 1,400–1,600 m, 17 May 1991, Y. L. Pei 9140 (PE); *loc. eodem*, 2 Sep. 2006, Y. Wang WY06094-LYP (PE). **SICHUAN**, **Guangyuan**, Zengjia, near Hongzhuan Farm, under rocks, 14 May 1959. C. F. Ling 4105 (SM). **Nanping**, Shuanghe Distr., 2,000 m, 15 May 1979, *Nanping Exped.* 0032 (SM). **Qingchuan**, Gonglong Township, Dawan Materia Medica Farm, 16 Sep. 1978, *s. coll.* 0573 (SM).

4b. *Paeonia rockii* subsp. *atava* (Brühl) D. Y. Hong & K. Y. Pan, *Acta Phytotax. Sin.* 43: 175 (2005). *Paeonia moutan* Sims subsp. *atava* Brühl, *Ann. Roy. Bot. Gard. (Calcutta)*, 5(2): 114, pl. 126 (1896); Grierson, *Fl. Bhutan* 1(2): 321 (1984) (pro syn. sub *P. suffruticosa*). *Paeonia suffruticosa* Andrews subsp. *atava* (Brühl) S. G. Haw & Lauener, *Edinburgh J. Bot.* 47(3): 280 (1990); Haw, *The New Plantsman* 8: 170 (2001). TYPE: China. Xizang [Tibet]: Chumbi, Tuk Chang, June 1884, King's Collector 549 (holotype K!).

Paeonia linyanshanii (S. G. Haw & Lauener) B. A. Shen subsp. *taibaishanica* (D. Y. Hong) B. A. Shen, *Lishizhen Medic. Mater. Med. Res.* 12(4): 331 (2001), nom. illeg.

Paeonia rockii (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong subsp. *taibaishanica* D. Y. Hong, *Acta Phytotax. Sin.* 36(6): 542, fig. 2 (1998). TYPE: China. Shaanxi: Mt Taibai, Shangbaiyun, 1,750 m, 24 May 1985, D. Y. Hong & X. Y. Zhu PB85061 (holotype PE!).

Paeonia suffruticosa auct. non Andrews: Grierson, *Fl. Bhutan* 1(2): 321 (1984).

PHENOLOGY. Flowering from late April to May; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, 1988; Yu *et al.*, 1987; Zhang & Sang, 1999).

HABITATS. Growing in deciduous forests at an altitude of 1,100–1,750 m.

DISTRIBUTION. According to our present knowledge, subsp. *atava* is confined to E Gansu, S Ningxia and Shaanxi on northern slopes of the Qinling Range and further N. Map 5.4.

NOTES. The subspecies is clearly differentiated from the typical one in having the leaflets ovate or ovate-orbicular, mostly or all lobed (Fig. 5.4C).

In this subspecies, the petals are usually white with a large, dark purple blotch at the base, but in the Longbagou Mountain, Xiashiwan Township (Ganquan County, Shaanxi Province), we found a population (D. Y. Hong, K. Y. Pan & Y. Ren H06003) in which white-flowered and red-flowered individuals coexisted.

Readers may feel surprised when we state that *P. rockii* subsp. *atava* (Brühl) D. Y. Hong is confined to a small area in eastern Gansu, southern Ningxia and Shaanxi, as the type was from Yadong, Xizang (Tibet). Hong (1997a) explained this clearly. *Paeonia rockii* subsp. *atava* is native to the Qinling Range and further north. It is highly possible that Buddhist monks from Mt Taibai in the Qinling Range cultivated this peony. Many individuals of this striking peony are cultivated in front of the Dadian Lamasery on Mt Tabai and distributed to lamaseries elsewhere.

ADDITIONAL SPECIMENS EXAMINED. CHINA, GANSU, Heshui, Taibai Forest Farm, Danpigou, 36°N, 108°40'E, 1,270 m, 21 May 2006, Y. Wang WY06029-HSP (PE). Tianshui, Baiyangling, Zhifanggou, 1,420 m, 20 July 1951, Z. W. Zhang 13 (PE). NINGXIA, Yongning, Wantaibao, 7 July 1973, Ningxia Phamaceutic Inspection Inst. Nan 124 (PE). SHAANXI, Ganquan, Xiashiwan Forest Farm, Mt Longbagou, 1,300 m, broad-leaved deciduous forests, 4 May 2006, D. Y. Hong, K. Y. Pan & Y. Ren H06003 (A, BM, K, MO, PE). Hwanglungshan, Baichengqiao, in thickets, 26 Aug. 1939, K. T. Fu 3412 (PE). Longxian, Y. L. Pei 916001 (PE). Mt Nanwutai, near Kuwanpeshu, 14 May 1939, T. N. Liou, P. C. Tsoong & C. S. Tien 127 (PE). Mt Taibai: 1,710 m, in forests, 13 Oct. 1985, X. Y. Zhu & Z. H. Wu PB85086 (PE); Dadian Lamasery, 2,300 m, in cultivation, 24 May 1985, D. Y. Hong & X. Y. Zhu PB85066 (PE); Shangbaiyun, 1,750 m, deciduous broad-leaved forests, on cliff, 20 May 1991, Y. L. Pei 916005 (PE); *loc. eodem*, 1,675 m, 12 May 2006, Y. Wang WY06020-TBP (PE); Shangbaiyun, in front of the temple, 1,820 m, in cultivation, 8 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97058 (A, CAS, K, MO, PE, US); Heihukuan, in bushes, 1,100–1,400 m, 5 May 1939, K. T. Fu 2584 (PE). Tongchuan, Jinsuo Township, Zhifang Village, 1,130 m, 7 May 2006, Y. Wang WY06012-TCP (PE). Zhidan, Zhidan Tomb, *Quercus* forest, 12 May 1985, L. R. Xu s.n. (PE).



Fig. 5.4C. *Paeonia rockii* subsp. *atava* (Bruhl) D. Y. Hong & K. Y. Pan: a lower leaf. Drawn by Miss LI Ai-Li.

5. *PAEONIA OSTII*

5. *Paeonia ostii* T. Hong & J. X. Zhang, *Bull. Bot. Res. Harbin* 12(3): 223, fig. 1 (1992); Hong & Pan, *Nordic J. Bot.* 19(3): 294, fig. 4 (1999); Hong & Pan, *Acta Phytotax. Sin.* 37(4): 363 (1999); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 129 (2001); Haw, *The New Plantsman*, 8: 163 (2001). *Paeonia suffruticosa* Andrews subsp. *ostii* (T. Hong & J. X. Zhang) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 30 (1997); Halda, *Gen. Paeonia*, 148 (2004). TYPE: Fig. 1 in Hong & Zhang, 1992: 231 (neotype here designated!).

Paeonia ostii T. Hong & J. X. Zhang var. *lishizhenii* B. A. Shen, *Acta Phytotax. Sin.* 35(4): 360 (1997). *Paeonia ostii* T. Hong & J. X. Zhang subsp. *lishizhenii* (B. A. Shen) B. A. Shen, *Lishizhen Medic. Mater. Med. Res.* 12(4): 330 (2001). TYPE: China, Anhui, Nanling, Yashan, 200–250 m, roadsides, 18 Apr. 1984, B. A. Shen PB1018 (holotype Wuhu Municipal Drug Bureau, Anhui Prov.; isotype PE!).

Paeonia suffruticosa Andrews subsp. *yinpingmudan* D. Y. Hong, K. Y. Pan & Z. W. Xie, *Acta Phytotax. Sin.* 36(6): 519, fig. 2 (1998), pro parte, excl. specim. ex Henan. *Paeonia yinpingmudan* (D. Y. Hong, K. Y. Pan & Z. W. Xie) B. A. Shen, *Lishizhen Medic. Mater. Med. Res.* 12(4): 330 (2001). TYPE: China, Anhui: Chaohu, Yinping Shan, on cliff, 28 Apr. 1997, K. Y. Pan & Z. W. Xie 9701 (holotype PE!).

Shrubs up to 1.5 m tall. Stems brown-grey. Lower leaves ternate-pinnate, with 11–15 leaflets; leaflets lanceolate to ovate-lanceolate, mostly entire, terminal leaflets often 2–3-lobed, very occasionally 1–2 lateral leaflets also 2-lobed, rounded at the base, acute to acuminate at the apex, 5–13 cm long, 2.5–6 cm wide, glabrous on both surfaces but sometimes pubescent at the base or the lower part of major veins above. Flowers solitary, terminal, single; involucre bracts 3–6 in number, green, leaf-like; sepals 4–6 in number, green-yellow, broad-elliptic or ovate-orbicular, 1.5–3.1 cm long, 1.5–2.5 cm wide, shortly caudate or acute at the apex; petals usually 11–14 in number, white, rarely pinkish, obovate, 5.5–8 cm long, 4–6 cm wide, entire or incised at the apex; filaments purple-red; anthers yellow; disk entirely enveloping carpels at anthesis, purple-red, leathery, dentate or lobed at the apex; carpels 5, densely tomentose; stigmas sessile, red. Follicles oblong, densely brown-yellow tomentose. Seeds brown-black, oblong-spherical or spherical, 8–9 mm long, 7–8 mm in diameter. Figs 5.5A, 5.5B.

PHENOLOGY. Flowering in April and May; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, 1988b, under *Paeonia* aff. *suffruticosa*).

HABITATS. In deciduous broad-leaved forests and thickets on slopes at an altitude of 300–1,600 m.

DISTRIBUTION. Native in Anhui (Chaohu) and W Henan (Lushi County and Xixia County) (Map 5.5); cultivated in Anhui, Henan, Hubei, Shaanxi, Sichuan, and other provinces. This species is widely but sporadically cultivated in China as a traditional medicine.

NOTES. The distinctive characters of *Paeonia ostii* are its ternate-pinnate lower leaves, with the leaflets 11–15 in number and ovate, ovate-lanceolate, mostly entire (Fig. 5.5A); flowers single and pure white, rarely pale pink; filaments red-purple; disk dark purple and stigmas red.

Paeonia ostii is considered a distinct species, but had been confused with *P. suffruticosa* subsp. *suffruticosa* (Pan, 1979). We have compared *P. ostii* to plants commonly cultivated for *mudanpi* (a famous Chinese traditional medicine) in Tongling, Anhui Province, the locality in which *mudanpi* is famously cultivated. They resemble each other very closely, and thus the plant commonly cultivated for *mudanpi* should be identified as *P. ostii*. *Paeonia ostii* is cultivated on a large scale in Tongling, Anhui Province, and to a lesser extent in other provinces such as Henan, Hubei, Shaanxi and Sichuan.

HONG Tao and his co-workers (Hong *et al.*, 1992: 225) stated that the shrub from which the type was collected was introduced from “Songxian, Yangshan, 1,200 m, in thickets on slopes”. We visited Songxian, Mt Yangshan, in Henan Province twice, in 1994 and 1997, and searched extensively

Fig. 5.5A (opposite). *Paeonia ostii* T. Hong & J. X. Zhang: a, the upper part of the shoot and a flower with petals and stamens shed, showing five carpels and the lacerated disk; b, a lower leaf. Drawn by Miss LI Ai-Li.





Map 5.5. Distribution of wild *Paeonia ostii* T. Hong & J. X. Zhang.

for *P. ostii* in the mountains. We did find the species cultivated in Secaogou Village, but not in the wild. In 1998, however, we found it in western Henan in Lushi County (D. Y. Hong *et al.* H98005).

We here designate a neotype for *Paeonia ostii*, since the original material cited in the protologue (Hong & Zhang, 1992) was not preserved. The protologue stated that it had been preserved in CAF but the keeper of the herbarium could not find it, and was told by HONG Tao that no holotype specimen had been preserved.

ADDITIONAL SPECIMENS EXAMINED. CHINA, ANHUI, Mt Jiuhua in cultivation, 28 Apr. 1986, D. Y. Hong & T. Chen PB86007 (PE). **HENAN, Huixian**, Mt Guanshan, Qilipo, c. 900 m, by and in waste fields, petals white to pale pink, cultivated(?), 5 May 2007, D. Y. Hong & K. Y. Pan H07001 (PE). **Lushi**, Guandu Township, Chenjia Village, 1,400 m, in deciduous *Quercus* forests, 16 May 1998, D. Y. Hong, K. Y. Pan, S. Y. Wang & G. Y. Rao H98005 (PE). **Neixiang**, Baotianman Nature Reserve, Muzhuliu Village, 800 m, cultivated, 30 Apr. 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97021 (PE). **Xixia**, 1,600 m in forests, 14 May 1988, J. Z. Qiu PB88302 (PE). **Songxian**: Jiulongdong, 1,200 m, cultivated(?), 7 May 1994, H. Y. Jia 001 (PE) and 002 (PE); Muzhuwa, 1,150 m, cultivated(?), 20 May 1994, H. Y. Jia 004 (PE) and 005 (PE); Nuzhaihuai, 1,150 m, cultivated(?), 24 May 1994, H. Y. Jia 011 (PE); Luanshitou, 1,250 m, cultivated(?), 25 May 1994, H. Y. Jia 034 (PE); Bailigou, 1,200 m, cultivated(?), 27 May 1994, H. Y. Jia 036 (PE) and 038 (PE); Bailigou, Dongling, 1,200 m, cultivated(?), 18 May 1994, H. Y. Jia 042 (PE) and 043 (PE). **HUBEI, Baokang**, Siping Town, Jiejiaping Village, cultivated, 5 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97052 (PE). **SHAANXI, Mt Taibai**, 1,350 m, in cultivation, 23 May 1985, D. Y. Hong & X. Y. Zhu PB85052 (PE). **Huangling**: Huangdi Tomb, cultivated, 4 May 1994, D. Y. Hong, K. Y. Pan & S. Z. Zhang 94007 (PE); *loc. eodem*, 10 May 1997, D. Y. Hong & Y. X. Feng H97069 (PE).

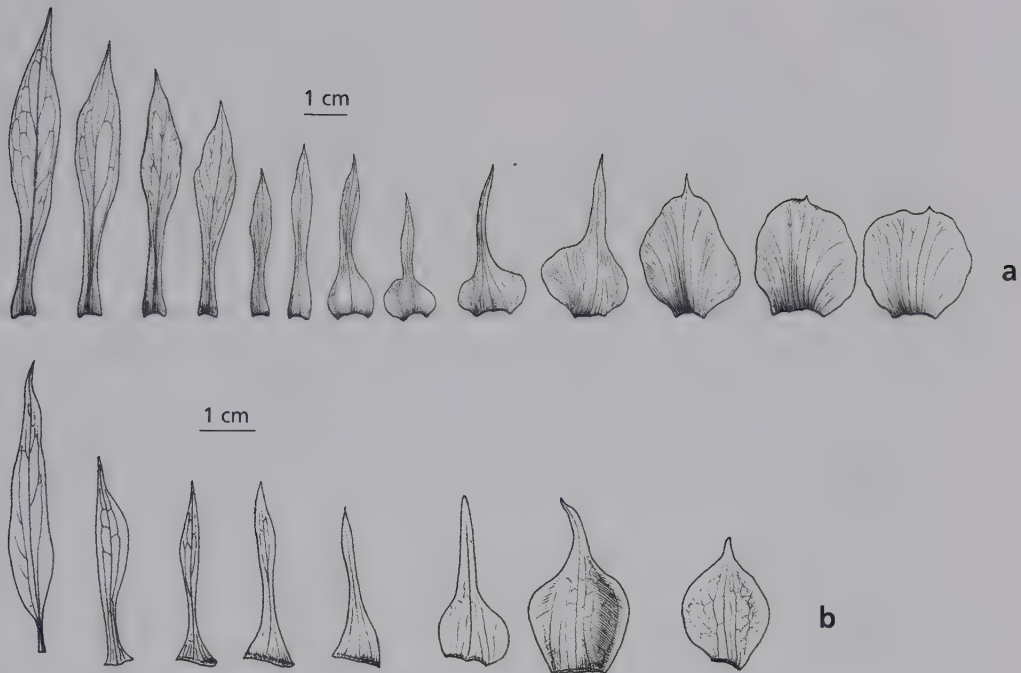


Fig. 5.5B. *Paeonia ostii* T. Hong & J. X. Zhang: involucre bracts and sepals, **a**, based on *D. Y. Hong & Y. X. Feng* H97069 (PE) (drawn by Miss LI Ai-Li); **b**, based on material in Beijing Botanic Garden, CAS (drawn by Mr SUN Yin-Bao).

6. *Paeonia jishanensis* T. Hong & W. Z. Zhao, *Bull. Bot. Res. Harbin* 12 (3): 225, fig. 2 (1992); Hong & Pan, *Nordic J. Bot.* 19: 292 (1999) and *Acta Phytotax. Sin.* 37(4): 362 (1999); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 128 (2001); Haw, *The Plantsman* 5 (4): 260 (2006); T. Hong & Osti, *Bull. Bot. Res. Harbin* 14(3): 238 (1994), pro syn. to *P. spontanea*; Haw, *The New Plantsman* 8: 163 (2001), pro syn. to *P. spontanea*. *Paeonia suffruticosa* Andrews subsp. *spontanea* (Rehder) S. G. Haw & Lauener var. *jishanensis* (T. Hong & W. Z. Zhao) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 30 (1997); Halda, *Gen. Paeonia*, 147 (2004). TYPE: Fig. 2 in Hong & Zhao, 1992: 232 (neotype here designated!).

Paeonia spontanea (Rehder) T. Hong & W. Z. Zhao in Hong & Osti, *Bull. Bot. Res. Harbin* 14(3): 238 (1994); Haw, *The New Plantsman* 8: 163 (2001); Hong & Pan, *Nordic J. Bot.* 19: 292 (1999), pro syn. to *P. jishanensis*. Basionym: *Paeonia suffruticosa* Andrews var. *spontanea* Rehder, *J. Arnold Arbor.* 1: 193 (1920), pro parte, excl. specim. Tai-Pei-Shan, *W. Purdom* s.n. (A!); *Paeonia suffruticosa* Andrews subsp. *spontanea* (Rehder) S. G. Haw & Lauener, *Edinburgh J. Bot.* 47(3): 278, fig. 1c (1990). TYPE: China. Shaanxi: "50 li West of Yunan Fu (Yan'an), 1910, *W. Purdom*" 338 (lectotype designated by Hong & Pan, 1999b: 362, A!; isolectotypes CAS!, E!, K!, P!, US!).

Shrubs to 1.8 m tall. Roots attenuate downwards. Turions present. Stems grey or grey-brown. Lower leaves biternate, with 9 leaflets, very occasionally terminal leaflets 3-fid to the base, and thus with 11 or 15 leaflets; leaflets ovate-orbicular or orbicular, 3-cleft, 4–8 cm long, 3–11 cm wide, glabrous above, villose along veins or throughout beneath; segments lobed, segments/lobes acute to rounded at the apex. Flowers solitary and terminal; involucre bracts 2–4 in number, long-elliptic, unequal in size; sepals 3 or 4 in number, green or yellow-green, broad-ovate, 2.5–5 cm long, 1.8–2.5 cm wide, all rounded at the apex; petals 5–11 in number, white, occasionally pinkish at the base or on margins, obovate, 4.5–7.2 cm long, 4–6 cm wide, irregularly incised at the apex; filaments pink or purple, white above, 8–10 mm long; anthers yellow, linear, 8–10 mm

long; disk entirely enveloping carpels at anthesis, red-purple, leathery, dentate at the apex; carpels 5, densely tomentose; stigmas red. Follicles oblong, densely brown-yellow tomentose. Seeds dark brown, nearly spherical, 8–9 mm in diameter. Figs 5.6A, 5.6B.

PHENOLOGY. Flowering from April to May; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (Yu *et al.*, 1987; Zhang *et al.*, 1997).

HABITAT AND DISTRIBUTION. In secondary deciduous broad-leaved forests and well-developed thickets at an altitude of 900–1,700 m. Native to N Henan (Jiyuan County), C Shaanxi (Huayin County and Tongchuan City), and SW Shanxi (Jishan and Yongji counties). Map 5.6.

NOTES. According to the protologue, the holotype of *Paeonia jishanensis* is preserved in CAF. However, when we visited this herbarium and asked HONG Tao for the holotype, we were told that it had not been preserved. Thus, we designate a neotype herein.

Haw (2001a: 163) used the specific name *Paeonia spontanea* (Rehder) T. Hong & W. Z. Zhao (in Hong *et al.*, 1994), while treating *P. jishanensis* T. Hong & W. Z. Zhao (1992) as its synonym. He cited T. Hong and Zhao's (1992: 226) statement "*P. suffruticosa* subsp. *spontanea* has petaloid stamens, which are an important characteristic developed after domestication of a wild tree



Map 5.6. Distribution of wild *Paeonia jishanensis* T. Hong & W. Z. Zhao.

Fig. 5.6A (opposite). *Paeonia jishanensis* T. Hong & W. Z. Zhao: a, a shoot and the terminal flower with petals and stamens shed; b, a lower leaf; c, carpels enveloped by disk; d, the lower surface of a leaf, showing villose hairs. Drawn by Miss LI Ai-Li.



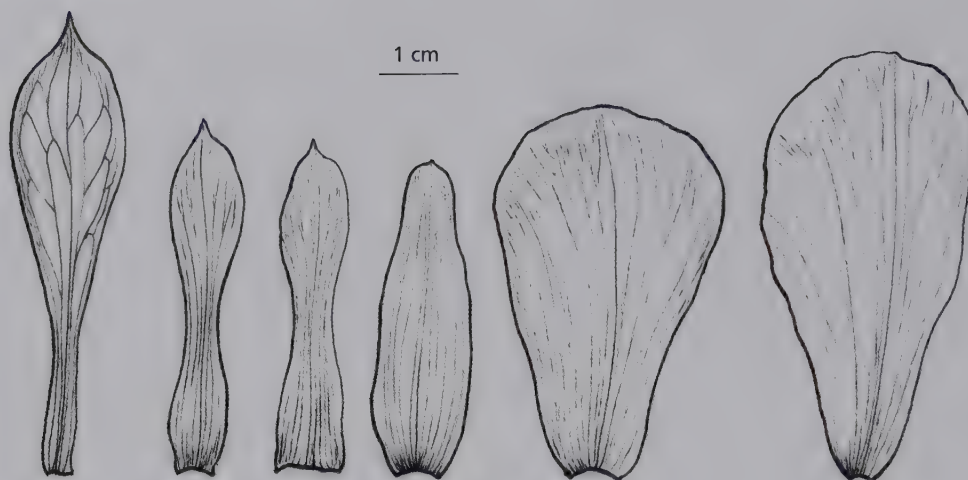


Fig. 5.6B. *Paeonia jishanensis* T. Hong & W. Z. Zhao: involucrate bracts and sepals, based on J. Z. Qiu PB89021 (PE). Drawn by Miss LI Ai-Li.

peony, so that *P. suffruticosa* subsp. *spontanea* should be reduced to the status of a cultivar, ‘*spontanea*’ (translated by Haw from the original Chinese). After the citation, Haw (2001a: 161) noted that “Hong and Zhao included the type of *P. suffruticosa* subsp. *spontanea* (i.e. *W. Purdon* 338) in their concept of the species *P. jishanensis*”, and concluded that “the name *P. jishanensis*, typified by *Hong Tao* 915010, is therefore, superfluous and illegitimate”. We (Hong & Pan, 1999a) restored *P. jishanensis* T. Hong & W. Z. Zhao as a valid specific name. Here, we still argue for its legitimate status. First, although T. Hong and Zhao (1992) did say that *P. suffruticosa* subsp. *spontanea* should be reduced as a cultivar, they did not say “in *P. jishanensis*”. Second, in the same paper, they (T. Hong & Zhao, 1992: 226) stated that “the present species (*P. jishanensis*) differs from *Paeonia suffruticosa* Andrews var. *spontanea* Rehder mainly in having petals white and lacking petaloid stamens.” This statement clearly indicates that *P. suffruticosa* var. *spontanea* was not included in the circumscription of *P. jishanensis* by T. Hong and Zhao (1992). The type of *P. jishanensis*, *Hong Tao* 915010, can not be confused with the type of *P. suffruticosa* var. *spontanea*, *W. Purdon* 338, as it was selected by Haw (2001a). Therefore, *P. jishanensis* T. Hong & W. Z. Zhao is a legitimate name.

The *Paeonia jishanensis* group has been treated at three different levels: as the variety *P. suffruticosa* var. *spontanea* by Rehder (1920), Stern (1946), Anonymous (1972), and Pan (1979); as the subspecies *P. suffruticosa* subsp. *spontanea* by Haw and Lauener (1990); and as an independent species by Hong and Zhao (in Hong *et al.* 1994). The most distinct morphological character of *P. jishanensis* is its calyx with three or two sepals, which are all rounded at the apex and rather large, up to 5 cm long (Fig. 5.6B). This calyx morphology is unique in sect. *Moutan* DC. Another distinct feature of this species is vegetative reproduction by turions, and these long scaly shoots produced from underground stem buds can reach over 1 m long. Seeds could scarcely be found. Digging roots of this species for market as *danpi*, a traditional Chinese medicine, was a serious activity for several years around 1960. The species probably escaped extinction solely because of its reproductive strategy of turions.

Paeonia jishanensis is rarely found in scattered locations in the Zhongtiao Mountains (Yongji County in Shanxi and Jiyuan County in Henan), the Luliang Mountains (Jishan County, Shanxi), the Huashan Mountains (Huayin County, Shaanxi), and Tongchuan and Yan’an (both in Shaanxi)

(Map 5.6). All of these populations, except the one in Yan'an (the type locality of *P. suffruticosa* var. *spontanea* Rehder), grow in thickets or secondary deciduous forests at altitudes from 900 to 1,700 m. The population in Yan'an consists of several individuals on the western side of the peony garden behind Zhaojun Temple in Wanhua Shan, and may well be introduced and naturalized there. Because the garden has probably been established for hundreds of years, and no one (including local people) knows its exact history and it is hard to give a definite answer about the history of *P. jishanensis* in Yan'an. All the populations mentioned above have purely white petals that are occasionally pinkish at the periphery.

ADDITIONAL SPECIMENS EXAMINED. CHINA, HENAN, Jiyuan: *s. loc.*, 1,050 m, 26 Apr. 1997, S. Y. Wang H97001 (MO, PE); Huanglianshu Forest Farm, 1,200 m, 22 May 1994, S. Y. Wang & Y. J. Zhang 940220 (PE). SHAANXI, Huayin, Mt Huashan, Xiaoxifeng, c. 1,300 m, 25 May 2006, Y. Wang WY06038-HYP (PE). Yan'an: Wanhua Shan, 36.6°N, 109.4°E, near the peony garden, 9 May 1997, D. Y. Hong & Y. X. Feng H97066 (PE); *loc. eodem*, W. Y. Hsia 3519 (PE); Shaanxi–Gansu Basin, T. Y. Le *s.n.* (PE). SHANXI, *s. loc.*, 1,390 m, 16 June 1916, P. Licent 1909 (PE). Jishan: Xishe, 1,550 m, May 1989, J. Z. Qiu PB89201 (PE); *loc. eodem* 1,440 m, J. Z. Qiu PB89501 (PE); Xishe, Majiagou Forest Farm, Chayuangou, 1,450 m, 14 May 1982, T. W. Liu & Z. F. Zeng 165 (PE); Xishe, Majiagou Village, 35.7°N, 110.9°E, 1,400 m, 14 May 1996, S. L. Zhou H96053 (A, K, MO, PE, US); *loc. eodem*, Y. L. Pei 9002 (PE); *loc. eodem*, Y. L. Pei & D. Y. Hong 93003 (PE), 93006 (PE), 93008 (PE) and 93009 (PE); *loc. eodem*, 1,135 m, 28 Apr. 2006, Y. Wang WY06000-JSP (PE); *loc. eodem*, 1,175 m, 29 Apr. 2006, Y. Wang WY06002-JSP (PE); *loc. eodem*, 1,100 m, 29 Apr. 2006, Y. Wang WY06001-JSP (PE). Yongji: Shuiyukou Village, Y. L. Pei 9170 (PE), 9180 (PE) and 9201 (PE); *loc. eodem*, Y. L. Pei & D. Y. Hong 93011 (PE) and 93427 (PE); *loc. eodem*, 970 m, 30 Apr. 2006, Y. Wang WY06004-YJP (PE); *loc. eodem*, 1,160 m, 1 May 2006, Y. Wang WY06006-YJP (PE).

7. *Paeonia qiui* Y. L. Pei & D. Y. Hong, *Acta Phytotax. Sin.* 33(1): 91, fig. 1 (1995); Hong & Pan, *Nordic J. Bot.* 19(3): 293 (1999); Hong & Pan, *Acta Phytotax. Sin.* 37(4): 363 (1999); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 128 (2001); Haw, *The New Plantsman* 8: 163 (2001). *Paeonia suffruticosa* Andrews var. *qiui* (Y. L. Pei & D. Y. Hong) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 31 (1997), in subsp. *spontanea* (Rehder) S. G. Haw & Lauener; Halda, *Gen. Paeonia*, 148 (2004). TYPE: China, Hubei: Shennongjia, Sunbai [Songbai] Town, 2,000 m, on steep precipice and overhanging rocks, 20 May 1988, J. Z. Qiu PB88034 (holotype PE!). *Paeonia ridleyi* Z. L. Dai & T. Hong, *Bull. Bot. Res. Harbin* 17(1): 1, fig. 1 (1997). TYPE: China, Hubei: Baokang Co., Laoyashan, Chongchongya (Changchongya), 1,400 m, 3 May 1994, Z. L. Dai 94053 (holotype Baokang Forestry Research Institute, Hubei!; photo PE!).

Shrubs up to 1.2 m tall. Roots up to 2 cm in diameter, cylindrical, attenuate downwards. Stems grey or brown-grey, longitudinally striate. Lower leaves biternate, always with 9 leaflets; leaflets often reddish above, mostly ovate, less frequently ovate-lanceolate or ovate-orbicular, rounded at the base, obtuse or acute at the apex, mostly entire, sometimes terminal leaflets shallowly 3-lobed, 4–12 cm long, 2–8 cm wide, usually glabrous above, densely villose at axils of major veins beneath. Flowers solitary, terminal; involucre bracts 2–4 in number, leaf-like; sepals mostly 3, rarely 2 or 4 in number, yellow green, acute or caudate at the apex, the inner one the largest, 2.5–3 cm long, 2–2.5 cm wide; petals 5–9 in number, spreading, pink or pale pink, often with a pale red spot at the base, 3.5–5.5 cm long, 2–3.1 cm wide; filaments pale pink to pink; anthers yellow; disk entirely enveloping carpels at anthesis, red-purple, leathery; carpels 5, densely tomentose; stigmas sessile, red, 1.5–2 mm wide. Follicles ellipsoid, densely brown-yellow tomentose, 2–2.8 cm long. Seeds black, glossy, 6–8 mm long, 5–7 mm in diameter. Figs 5.7A, 5.7B.

PHENOLOGY. Flowering from late April to May; fruiting in August.

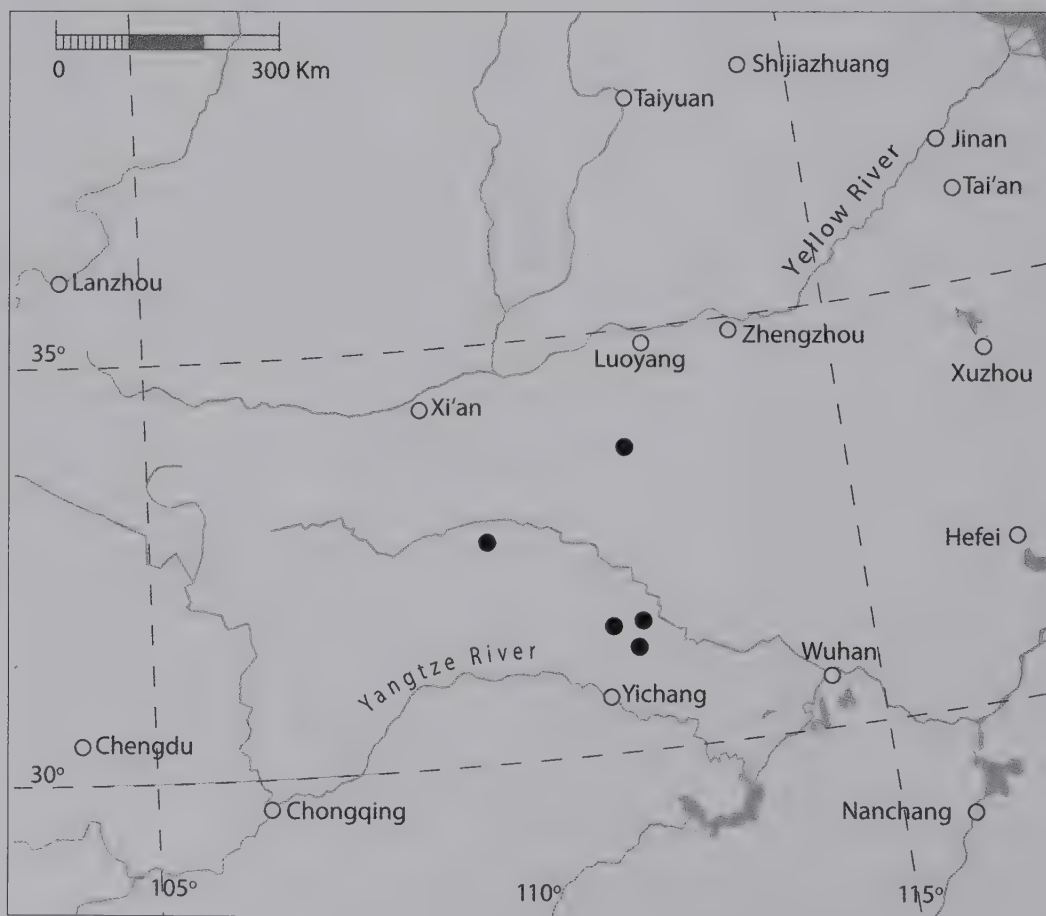
CHROMOSOME NUMBER. $2n = 10$ (the present work with the vouchers: China, Hubei Prov., Shennongjia, Chen & Ma PB86013 (PE), PB86014 (PE) and PB86015 (PE)).

HABITAT AND DISTRIBUTION. Mostly in deciduous broad-leaved forests, rarely on sunny grassy slopes, on limestone rocks or cliffs, at altitudes of 1,000–2,200 m. Confined to W Henan (Xixia County) and W Hubei (Baokang County and Shennongjia). Map 5.7.

To date, *Paeonia qiui* has been found in only four localities. Three of the four remaining populations were found on cliffs and comprised only a few individuals. It is surely the most endangered species in *Paeonia*, on the verge of extinction, and therefore effective measures must be undertaken urgently to conserve the species. Prof. LI Zhen-Yu informed me recently that he saw this species with certainty in Zhuxi County of Hubei Province.

NOTES. *Paeonia qiui* is characterised by having biternate lower leaves consistently with 9 leaflets, which are ovate-lanceolate to broad-ovate, mostly entire and densely villose at the axils of major veins beneath (Fig. 5.7A). It has whitish pink or pink petals, often with a pale red blotch at the base. Apparently, *P. qiui* is most closely related to *P. cathayana* and *P. jishanensis*. It sometimes reproduces vegetatively by turions.

ADDITIONAL SPECIMENS EXAMINED. CHINA, HENAN, **Xixia**, in forests, 1,600 m, May 1988, J. Z. Qiu PB88305 (PE). HUBEI, **Baokang**: Houping Township, Hongjiayuan, in front of Mr Su Yuan-Zhi's house, in cultivation, 2 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97023 (A, K, MO, PE, US); *loc. eodem*, Yanghu Shan, 1,000 m, limestones, in secondary forests, 2 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97027 (MO, PE) and H97028 (MO, PE); Houping Township, Chefongping, 1,300 m, E slope, on limestone cliffs, 3 May 1997, D. Y. Hong, Y. Z. Ye & Y. X.



Map 5.7. Distribution of wild *Paeonia qiui* Y. L. Pei & D. Y. Hong.



Fig. 5.7A. *Paeonia qiui* Y. L. Pei & D. Y. Hong: **a**, the lower part of the shoot; **b**, a flower with petals and stamens shed, showing five carpels and the lacerated disk; **c**, a lower leaf; **d**, a follicle; **e**, the lower surface of a leaf, showing dense villose hairs at axils of veins. Drawn by Miss LI Ai-Li.

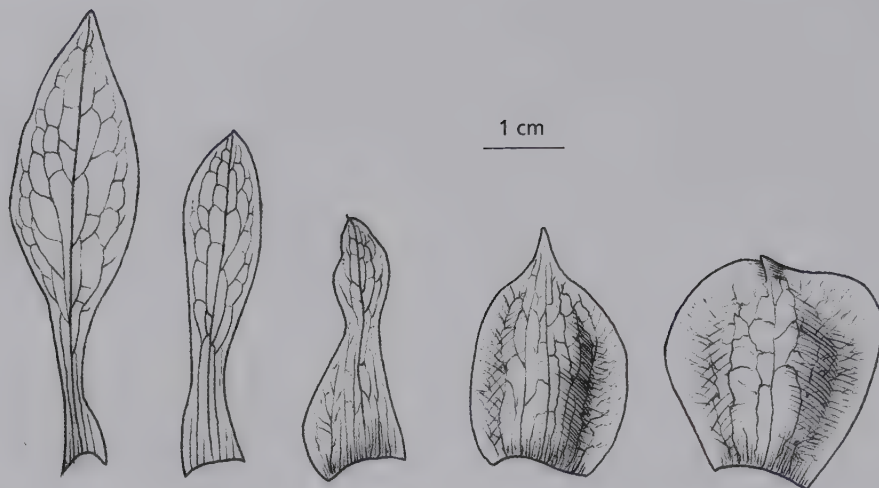


Fig. 5.7B. *Paeonia qiui* Y. L. Pei & D. Y. Hong: involucrate bracts and sepals, based on T. Chen & L. M. Ma PB86012 (PE). Drawn by Mr SUN Yin-Bao.

Feng H97029 (A, K, MO, PE, US); *loc. eodem*, Wudaoxia, 1,000 m, 4 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97045 (PE). **Shennongjia**: Songbai Town, 25 Apr. 1988, J. Z. Qiu PB88018 (PE) and PB88021 (PE); *loc. eodem*, 1,800–2,010 m, 6 May 1988, J. Z. Qiu PB88022 (PE); *loc. eodem*, 2,010 m, in forests, 6 May 1988, J. Z. Qiu PB88023 (PE); *loc. eodem*, 4 May 1991, Y. L. Pei 911001 (PE); Songbai Town, sunny grassy slopes, 2,200 m, 19 May 1986, T. Chen & L. M. Ma PB86012 (PE), PB86013 (PE), PB86014 (PE) and PB86015 (PE); *loc. eodem*, Mt Shantunya, 2,000 m, 7 Aug. 2004, D. Y. Hong & Z. Q. Zhou H04041 (PE).

8. *Paeonia cathayana* D. Y. Hong & K. Y. Pan, *Acta Phytotax. Sin.* 45(3): 286, fig. 2 (2007). TYPE: China, Henan: Songxian, Muzhijie Township, Shigunping, Secaogou Village, cultivated by Mr YANG Hui-Fang's house, 28 Apr. 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97010 (holotype PE!; isotype MO!).

Paeonia suffruticosa Andrews subsp. *yinpingmudan* D. Y. Hong, K. Y. Pan & Z. W. Xie, *Acta Phytotax. Sin.* 36(6): 519 (1998), pro parte, quoad specim. ex Henan.

Paeonia yinpingmudan (D. Y. Hong, K. Y. Pan & Z. W. Xie) B. A. Shen subsp. *henanensis* (D. Y. Hong, K. Y. Pan & Z. W. Xie) B. A. Shen, *Lishizhen Medic. Mater. Med. Res.* 12(4): 330 (2001), nom. illeg.

Shrubs about 0.8 m tall. Leaves glabrous; lower leaves biternate, with 9 leaflets; terminal leaflets obovate-deltoid, 8–10 cm long, 7–9 cm broad, 3- or 5-cleft to the middle or even beyond, lateral leaflets ovate or ovate-lanceolate, 4–7 cm long, 2–4.5 cm broad, entire or shallowly lobed. Flowers solitary, terminal, single; involucrate bracts 2–6 in number, glabrous; sepals 4–5 in number, all caudate at the apex, 3–3.5 cm long, 2–3 cm broad, glabrous; petals 9 or 10 in number, rose, broadly obovate, rounded at the apex, 5–6 cm long, 4–6 cm broad; filaments purple, anthers yellow; disk entirely enveloping carpels at anthesis, purple; stigmas purple. Figs 5.8A, 5.8B.

PHENOLOGY. Flowering from late April to early May.

CHROMOSOME NUMBER. $2n = 10$. (All the cultivars cytologically examined have $2n = 10$; as a progenitor of the cultivars, the species should have chromosome number $2n = 10$.)

DISTRIBUTION. Native to W Henan (Songxian) and W Hubei (Baokang). Map 5.8.

NOTES. When we (Hong *et al.*, 1998b) described *Paeonia suffruticosa* subsp. *yinpingmudan* as new, we cited two specimens, one from a cliff in the Yinping Hill, Chaohu, Anhui Province (K. Y. Pan &



Fig. 5.8A. *Paeonia cathayana* D. Y. Hong & K. Y. Pan: **a**, the lower part of the shoot; **b**, the upper part of the shoot; **c**, a lower leaf. Drawn by Miss LI Ai-Li.



Map 5.8. Distribution of wild *Paeonia cathayana* D. Y. Hong & K. Y. Pan.

Z. W. Xie 9701) and the other from a cultivated shrub next to Mr YANG Hui-Fang's house in Secaogou Village, Shigunping, Muzhijie Township, Songxian County, Henan Province (D. Y. Hong, Y. Z. Ye & Y. X. Feng H97010). The former has only one leaf and several white petals, whereas the latter, with rose petals, was introduced from a nearby mountain around 1961, as Mr Yang told us. These two specimens were considered to form a single entity, and possibly a wild form of the cultivated tree peony on the basis of similarity of the leaves, although they had different petal colours. It is regretful that we designated 9701, instead of H97010, as the type of *P. suffruticosa* subsp. *yinpingmudan*, considering that the former came from an individual of wild origin with considerable certainty, but ignoring its incompleteness as a specimen.

Our recent DNA sequencing data do not support this taxonomic treatment. On all the molecular trees of the nuclear *GPAT* gene, the nuclear gene family *Adh1A*, *Adh1B* and *Adh2*, and cpDNA, K. Y. Pan & Z. W. Xie 9701 and *P. ostii* formed a clade, whereas H97010 either formed an independent clade or formed a clade with *P. qiui* (Zhao *et al.*, 2004; Lin *et al.*, 2004; Zhou *et al.*, unpub.).

Haw (2006) strongly argued that *Paeonia suffruticosa* subsp. *yinpingmudan* from Anhui is an element of *P. ostii*, but not the direct progenitor of *P. suffruticosa*. According to his observation, the peony on the cliff from Yinping Hill in Anhui Province has lower leaves with 11 instead of 9 leaflets. Mr LI Min and Mr MA Xin-Tang made a trip to Yinping Hill in April of 2006 to further observe the peony on the cliff. They collected petals falling down the cliff and took a large number of photos using a telelens. According to their photos, the lower leaves of this tree peony actually have 13 (not nine) leaflets, which are ovate-lanceolate or ovate, and mostly entire (Hong & Pan, 2007; fig. 1). The leaf of the type specimen of *P. suffruticosa* subsp. *yinpingmudan* (Pan & Xie 9701, with nine leaflets) (Hong *et al.*, 1998b; fig. 2) might be a middle leaf but not a lower one. The flowers of this type specimen

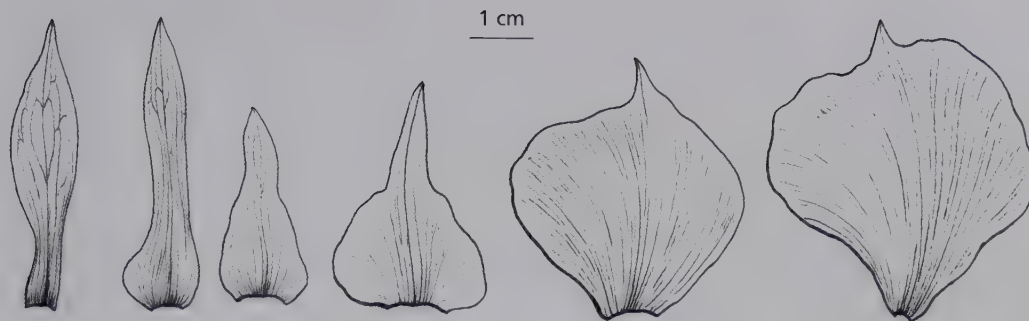


Fig. 5.8B. *Paeonia cathayana* D. Y. Hong & K. Y. Pan: involucre bracts and sepals, based on D. Y. Hong, Y. Z. Ye & Y. X. Feng H97010 (MO, PE). Drawn by Miss LI Ai-Li.

are purely white, with purple filaments and disc. Therefore, there are no significant differences between the tree peony on the cliff (Pan & Xie 9701) and the specimens of *P. ostii* that we have examined to date. The tree peony in Songxian of Henan Province (Hong *et al.* H97010) (Fig. 5.8A), however, differs from *P. suffruticosa* subsp. *yinpingmudan* in having the lower leaves strictly with nine leaflets, mostly lobed, and rose petals. Therefore, the two collections of tree peonies cited when *P. suffruticosa* subsp. *yinpingmudan* was described as new actually belong to two different entities, Pan & Xie 9701 (Anhui) being an element of *P. ostii* as shown by DNA data and as stated by Haw (2006), whereas Hong *et al.* H97010 (Henan) might be a real wild form of the cultivated tree peony. Thus, *Paeonia suffruticosa* subsp. *yinpingmudan* from Anhui is reduced herein to a synonym of *P. ostii*, whereas the tree peony from Henan has been described as a new species, *P. cathayana* (Hong & Pan, 2007).

Mr B. A. Shen's *Paeonia yinpingmudan* subsp. *henanensis* (Shen, 2001) is an illegitimate name because D. Y. Hong and his co-workers never gave the Latin name '*henanensis*', and neither did Mr Shen designate a type for his name '*henanensis*'. However, from Mr Shen's short note in Chinese, his '*henanensis*' is clearly connected with Hong, Ye & Feng H97010.

ADDITIONAL SPECIMEN EXAMINED. CHINA, HUBEI, Baokang County, Houping Township, Fanshenshang Village, 24 Apr. 2005, Z. L. Dai 2005001 (PE).

II. *PAEONIA* sect. *ONAEPIA* Lindl.

(species 9 and 10)

9. *Paeonia brownii* Douglas ex Hook., *Fl. bor.-amer.* 1: 27 (1829); Torrey & Gray, *Fl. N. Amer.* 1: 41 (1838); Lindley, *Bot. Reg.* 25: tab. 30 (1839); Lynch, *J. Roy. Hort. Soc.* 12: 433, fig. 24 (1890); Huth, *Bot. Jahrb. Syst.* 14(3): 273 (1891); Stebbins, *Madroño* 4(8): 252–260, pl. 37, figs f–n (1938); Stern, *J. Roy. Hort. Soc.* 68: 124 (1943); Stern, *Study Gen. Paeonia*, 51 (1946). TYPE: Oregon, USA, "near the confines of perpetual snow, on the subapline range of 'Mount Hood.'" June–July 1826, D. Douglas s.n. (holotype K!).

Perennials, glabrous throughout except for leaf margins. Roots all slightly fusiform, up to 2.4 cm in diameter, brown-black outside. Caudex (rhizomes) up to 12 cm long, 0.6–1.3 cm in diameter; stems 15–48 cm tall, up to 1 cm in diameter, with 5–7 scales at the base, usually with no branches but sometimes with fertile or sterile branches. Lower leaves biternate with 9 leaflets, petioles 3–7 cm long; each leaflet with several segments, each segment with several final lobes; segments 0.3–2.0 cm wide; final lobes 59–110 in total, oblong or ovate-lanceolate, rounded or acute, sometimes mucronate at the apex, 0.2–1.2 cm wide, margins thickened and recurved, sometimes with bristles. Flowers terminal, solitary or up to 4 on a stem, pendent; involucre bracts

1–2 in number, leaf-like; sepals 3–5 in number, green or purple or green but purple at the periphery, more-or-less larger than petals, rounded, 1–2.2 cm long, 1.1–2.1 cm wide; petals 7–10 in number, orbicular, red-brown or brown-purple, often yellow at the periphery, entire, 0.8–1.5 cm long, 0.6–0.9 cm wide, incurved and never fully expanded; stamens numerous; filaments pink, anthers yellow; disk fleshy, dentate, 3 mm high; carpels mostly 5, rarely 4, very occasionally 6, 3 or 2 in number; stigmas sessile, 1.5–1.9 mm long, c. 1 mm wide, purple, horizontal. Follicles cylindrical, 2–4 cm long, 1.2–1.9 cm in diameter. Seeds black, oblong, 10–12 mm long, 6–6.5 mm in diameter. Figs 5.9A, 5.9B.

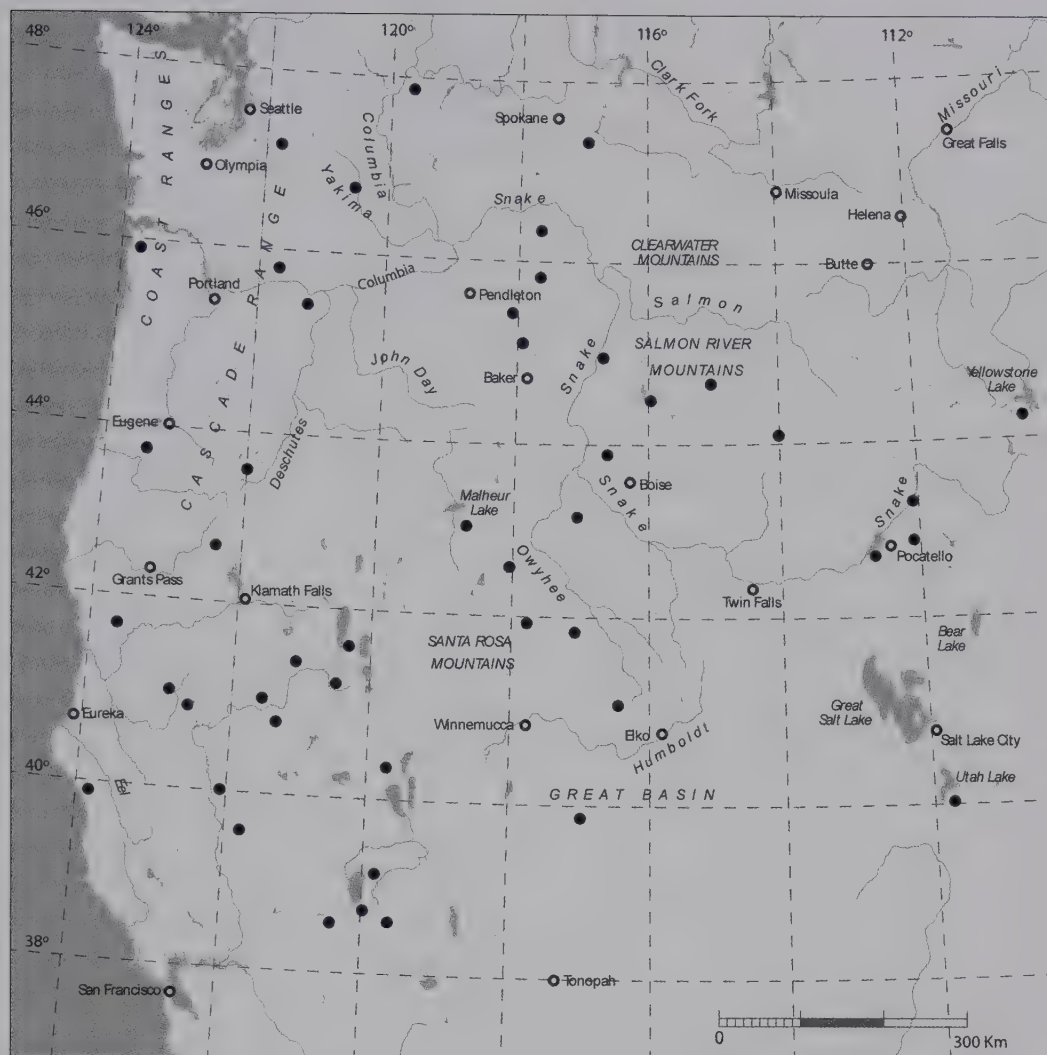
PHENOLOGY. Flowering from March to June, but mostly in May and early June.

CHROMOSOME NUMBER. $2n = 10$ (Stebbins, 1938b; Stebbins & Ellerton, 1939; Zhang & Sang, 1998).

HABITAT AND DISTRIBUTION. Usually growing in sparse chaparral, open places in chaparral or woods of *Pinus*, *Picea* or *Populus*, or on grassy slopes. The plants with which it is most frequently associated are *Pinus ponderosa*, *Pseudotsuga menziesii*, *Calocedrus decurrens*, *Populus tremuloides*, *Larix* sp., *Castanopsis* sp., *Ceanothus* sp. and *Artemisia* spp. The species mostly occurs in granite soils or on volcanic rocks at altitudes from 600 to 2,600 m. Confined to the USA and distributed in N California, Idaho, Nevada, Oregon, Utah, Washington and Wyoming (Fig. 4.3 and Map 5.9).

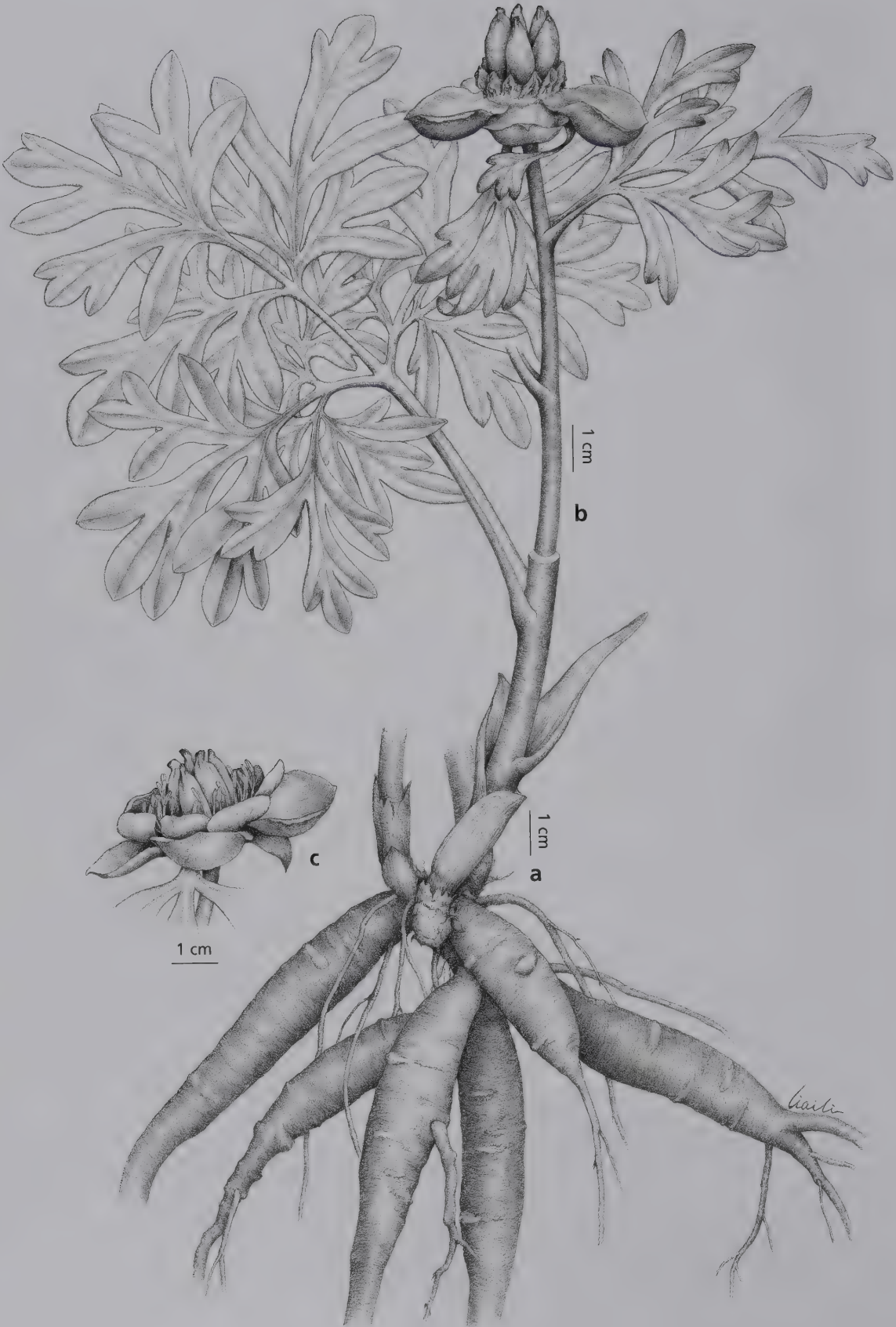
NOTES. Of the two species in sect. *Onaepia*, *Paeonia brownii* is distinct with lower leaves having 9 leaflets, carpels mostly 5, less frequently 4 in number, and petals always smaller than sepals. The two species are allopatric.

ADDITIONAL SPECIMENS EXAMINED. **USA, CALIFORNIA, Adin County:** from Adin to Medeline, above Ash Greek Public Camp, open slopes with *Artemisia* scrubs, 1,580 m, 19 May 1950, *E. K. Balls* 14774 (A). **Alpine County:** Sierra Nevada, E end of Hope Valley, along Carson River, 2,130 m, in dense grove of *Populus tremuloides*, 14 June 1962, *D. E. Breedlove* 3611 (CAS); Hope Valley, S of Luther Pass, 18 May 1968, *E. McClintock*, *M. Williams* & *W. Roderick* s.n. (CAS). **Amador County,** Silver Lake, Kit Carson Pass, 15 June 1955, *O. Reitschneider* s.n. (CAS). **Butte County:** Balby, July 1894, *R. M. Austin* 144 (MO); Jonesville, Sierra Nevada, yellow pine belt, 1,680 m, under scrubs of *Castanopsis* and *Ceanothus*, 11 June 1915, *A. A. Heller* 12046 (CAS, F, MO, US). **El Dorado County:** Lake Tahoe, state line, wood borders, 1,900 m, 1 July 1925, *F. W. Peirson* 6168 (A); *loc. eodem*, 11 June 1922, *W. Hulclunson* 3550 (A); on road to Luther Pass, Alpine Campground, 1,950 m, 30 May 1958, *J. L. Pawek* 439 (CAS); Deer Park, 15–19 June 1912, *A. Eastwood* 362 (CAS). **Mt Hamilton,** eastern side, chaparral, 1,070 m, 15 May 1937, *H. K. Sharsmith* 3947 (A). **Lake County:** 1.5 km SE of Borax Lake, 6 Apr. 1947, *M. S. Baker* 11657 (A); near summit of Mt Sanhedrin, 20 July 1920, *A. A. Heller* s.n. (MO); Mt Bartlett, 6 May 1928, *L. R. Abrams* 12416 (CAS); 9 km from Clear Lake, 760 m, 6 May 1928, *C. B. Wolf* 1999 (US). **Lassen County:** near Lost Lake, Warner Mts, c. 2,440 m, 14 June 1934, *J. T. Howell* 12146 (CAS); Hallelujan Junction, 1,490 m, 26 July 1974, *M. & S. Williams* 74-L-14 (CAS); Loyalton, Sierra Valley, 1,520 m, *J. W. Morrison* s.n. (A). **Mendocino County:** road to Eden Valley, 6 May 1973, *T. Nelson & D. Anderson* 885 (A); Patter Valley, *C. A. Purpus* s.n. (A); N part, Blair's Hill, 30 July 1909, *J. McMurphy* 638 (A, CAS). **Modoc County:** Surprise, 13 June 1940, *A. Eastwood & J. T. Howell* 8117 (A, CAS); 15 km E of Likely, in crevices of balsaltic talus, 1,430 m, 14 May 1953, *W. A. Weber* 8372 (A, CAS, W); Howard's Gulch Public Camp, 1,430 m, 17 May 1950, *E. K. Balls* 14736 (A); Patterson Meadows, Warner Range, 2,200 m, 13 July 1979, *S. O. Matton* 95 (A); South Fork Pit River, Likely to Clear Lake, on edges of woodlands, 20 May 1950, *E. K. Balls* 14795 (A); E of Goose Lake, 1.5 km S of Willow Ranch, 1,340 m, 3 June 1975, *C. Davidson* 2587 (A); extreme NE corner, just S of the Oregon border, Juniper Savana with *Populus tremuloides*, 1,630 m, 29 Apr. 1989, *B. Bartholomew & B. Anderson* 4686 (CAS); S end of Warner Mts, near Patterson Campground, Sierra montane forests, 2,190 m, 24 June 1988, *B. Bartholomew & B. Anderson* 4368 (CAS); E of Mt Bald, E side of Warner Mts, 41°37'N, 120°16'W, 2,230 m, 2 July 1994, *B. Bartholomew* 6815 (CAS); c. 1 km NW of Mt Bald, E side of Warner Mts, 41°37'N, 120°17' W, 2130–2,290 m, 24 June 2002, *B. Bartholomew & H. Sun* 8838 (PE); W bank of Stough Reservoir, Warner Mts, 1,520 m, 11 June 1988, *K. & R. Paulson* 36 (CAS). **Mono County:**



Map 5.9. Distribution of *Paeonia brownii* Douglas ex Hook.

E of Sonora Pass, 2,590 m, open slope, 23 July 1932, *F. W. Peirson* 10382 (A); 6 km E of Sonora Pass, 2,590 m, near granite rocks, 27 July 1941, *R. C. Rollins* 2990 (CAS); E of Sonora Pass, c. 2,530 m, 24 June 1963, *M. Williams* s.n. (CAS). **Nevada County:** along the base of the ridge between Donner Lake and Coldstream, 17 July 1903, *A. A. Heller* 6954 (MO); Truckee, Sierra Nevada, 6 May 1891, *C. F. Sonne* 10 (MO). **Plumas County:** c. 22 km N of Blairsden, large montane meadow, N side of Coldwater Spring, Grizzly Valley, 2,070 m, 17 June 1981, *M. S. Taylor* 3927 (MO); Dixie Valley, between Squaw Valley and Red Clover Valley, sagebrush scrubs, 10 May 1982, *T. Ratcliff* s.n. (MO); Frenchman Lake, c. 20 km N of Chilcoot, 1,740 m, sagebrush scrub, on edges of Jeffrey pine forests, 13 July 1981, *M. S. Taylor* 3996 A (MO); 8 km N of Chilcoot, 1,520 m, 16 May 1947, *P. A. Munz* 11816 (A); Plumas National Forest, Milford Range Distr., W of Frenchman Lake, in chapparal, 7 June 1999, *M. A. Vincent* 8518 (CAS); E of Frenchman Reservoir, N of Chilcoot, sagebrush areas, 1,710 m, 18 May 1968, *E. McClintock* s.n. (CAS). **Shasta County:** Mt Shasta, Burney Spring, near edges of meadows, 1,430 m, 16 July 1932, *F. W. Peirson* 10312 (A); near Yreka, 8 May 1876, *E. A. L. Greene* 755 (F, MO); Willow Creek Ranch, 880 m, *Pinus-Pseudotsuga-Calocedrus* forests, on grassy



slope, 29 May 1995, *F. Almeda & R. Erisendardt* 7420 (CAS). **Sierra County**, Packer Lake, 1,980 m, 24 June 1927, *H. A. Baker* 735 (A). **Siskiyou County**: Juartz Valley, 23 Apr. 1910, *G. D. Butler* 1229 (A, CAS, MO); on Pumice U. S. Highway, under shrubs of *Arctostaphylos* and *Purshia*, 30 May 1962, *P. H. Raven* 17993 (A); W of Scott Valley, 910 m, pine forests, 18 May 1948, *D. Parker* s.n. (A); Whitehorse Mts, near Modoc County line, open *Pinus ponderosa* forests, 41°16'N, 121°27'W, 1,600 m, *B. Bartholomew* 6708 (CAS); S side of Mt Shasta, 15–31 July 1897, *H. E. Brown* 564 (F, US); Mt Shasta, Wagon Campos area, 1,700 m, 18 July 1941, *Cooke* 16084 (F). **Trinity County**, Big Flat, 21 July 1937, *J. T. Howell* 13238 (CAS). **Yuba City**: E of Grass Valley, S slope, 760 m, 26 June 1933, *L. Benson* 4523 (A); Yuba Pass, June 1932, *B. R. Jackson* s.n. (A). **IDAHO**, **Adams County**: Evergreen Camp, 16 May 1946, *H. W. Davis* s.n. (IDS); *loc. eodem*, 16 May 1943, *R. J. Davis* 4498 (IDS); 30 km S of New Meadows, near highway to Weiser, granites, 24 June 1946, *C. L. Hitchcock & C. V. Muhlick* 13869 (CAS, MO). **Avery**: SE Avery, open hillside, 1,220 m, 21 May 1927, *E. E. Stanford* 375 (A). **Bannock County**: Cherry Springs, 8 May 1975, *M. Walker* s.n. (IDS); Pocatello Creek, open ground, 27 Apr. 1945, *H. W. Davis* s.n. (IDS). **Blaine County**: 15 km N of Ketchum, by Wood River, 1,910 m, 18 June 1941, *A. Cronquist* 2508 (IDS, MO); Soldier Mts, 2,440 m, 26 June 1916, *J. F. Macbride & E. B. Payson* 2886 (MO). **Boise County**, glade, 24 May 1972, *M. S. Johnson* 72 (IDS). **Clark County**, 11 June 1975, *E. Bottun* 70 (IDS). **Custer County**, 22 km NW of Stanley, along Meadow Creek, 2,010 m, 28 June 1941, *A. Cronquist* 2746 (IDS, MO). **Elmore County**: 16 May 1937, *G. Leiniger* s.n. (IDS); Trinity, 1,370 m, 8 Aug. 1910, *J. F. Macbride* 536 (CAS, F, MO). **Idaho County**, 15 km E of McCall, Payette National Forest, *Pinus–Pseudotsuga–Larix* forests, 11 July 1935, *A. H. Holmgren & S. S. Tillett* 9544 (CAS). **Owyhee County**: *s. loc.*, 25 June 1946, *R. J. Davis* 4626 (IDS); Silver City, 30 May 1936, *H. M. Tucker* 573 (IDS); Silver City, 2,130 m, 20 June 1911, *J. F. Macbride* 943 (CAS, F, MO). **Pocatello**: Inkom, Inman Creek, dry slope, 29 Apr. 1954, *G. H. Spahr* s.n. (IDS); McCammon, 8 May 1946, *A. C. Everson* s.n. (IDS); Gibson Jack, c. 1,500 m, S slope with sparse *Cupressus* trees, sagebrushes and grasses, 16 Aug. 1999, *D. Y. Hong & Q. Y. Xiang* H99076 (PE). **Valley County**: above head of Payette Lake, rocky slopes, 30 May 1944, *C. L. Hitchcock & C. V. Muhlick* 8531 (CAS, IDS); 8 km S of Lowman, granites, 26 May 1964, *C. L. Hitchcock* 23533 (CAS). **Washington County**: Cuddy Mts, 1,830 m, 11 July 1899, *M. E. Jones* 6134 (MO); Spring Creek, 1,680 m, 16 Aug. 1941, *R. J. Davis* 4155 (IDS). **NEVADA**, Mt Diamond, summit, Susanville, Perkin's Ranch, 2,220 m, 28 June 1897, *E. Marcus & A. M. Jones* s.n. (A). **Douglas County**, 3 km E of Tahoe Lake, open forests, 2,150 m, 16 Aug. 1979, *P. Rubtzoff* 9309 (CAS). **Elko County**: Burnt Creek, 18 km N of Wells, *Salix* thickets, 10 June 1939, *B. Maguire* 16818 (CAS, IDS); Hayes Creek, Independence Mts, dry gravelly sagebrush slopes, 11 Aug. 1948, *B. Maguire & A. H. Holmgren* 22462 (MO); Jarbidge Ranger Station, 1,940 m, 16 Aug. 1917, *W. W. Eggleston* 14124 (US). **Humboldt County**: Jackson Mts Above Iron King Mine, 2,440 m, 18 June 1970, *N. H. Holmgren, J. J. Fay & B. L. Bethers* 4260 (W); Santa Rosa Range, Humboldt National Forest, NE of Winnemucca, 2,200 m, 18 June 1967, *J. L. Gentry & J. G. Davidse* 1569 (CAS, MO, W). **Landen County**, Birch Creek, 27 June 1931, *J. M. & M. A. Linsdale* 466 (CAS). **Ormsby County**, King's Canon, 1,700–2,000 m, 1 July 1902, *C. F. Baker* 899 (F, MO, US). **Rowland**: Wiablo Mt, 2,290 m, hillside, N slope, gravelly loam, sage-grasses, 27 May 1938, *K. B. Platt* s.n. (IDS); Sode Spring, 2,130 m, July 1881, *E. Marcus & A. M. Jones* s.n. (A). **Washoe County**: S of Marmol Station, 1,680 m, 13 May 1912, *A. A. Heller* 9997 (CAS, F, MO, US); Hunter Creek Canyon, 20–25 June 1907, *P. B. Kennedy* s.n. (CAS); Mt Peavine, NE of Peavine Peak, near Bordtown, 1,580 m, 24 May 1975, *M. Williams, P. Lott & E. McPherson* 75-16-27 (CAS). **OREGON**, **Baker County**, Blue Mts, 2,320 m, 8 July 1919, *R. S. Ferris*

Fig. 5.9A (opposite). *Paeonia brownii* Douglas ex Hook.: **a**, the lower part of the plant showing fusiform roots, scales at the base of the stem, and a lower leaf; **b**, the upper part of the plant and a flower with petals and stamens shed, showing the dentate disk and carpels; **c**, a flower, showing petals smaller than sepals. Drawn by Miss LI Ai-Li.

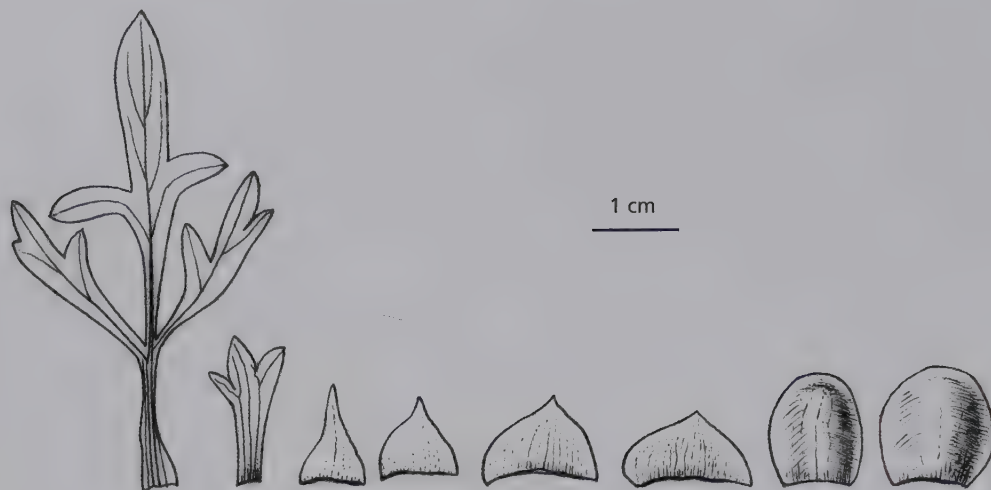


Fig. 5.9B. *Paeonia brownii* Douglas ex Hook.: involucrate bracts and sepals, based on 7701 (PE). Drawn by Mr SUN Yin-Bao.

& R. Duthie 922 (CAS). **Crook County**, Blue Mts, 1,400 m, 19–21 July 1915, *W. W. Eggleston* 11368 (US). **Deschutes County**, Deschutes River, Deschutes National Forest, Dillon Falls, volcanic soils, 43°57'N, 121°25'W, 1,260 m, 17 July 1993, *H. H. Schmidt & R. D. Noyes* 789 (MO). **Grant County**: John Day Valley, open pine woods, 8 June 1925, *L. F. Henderson* 5143 (CAS, MO); just S of Meadow Creek Pass, 9 km SW of Dale, 1,220 m, 19 May 1950, *A. Cronquist* 6380 (US). **Harney County**, near Wildhorse Creek, lower flanks of Steens Mts, 10 June 1927, *L. F. Henderson* 9043 (CAS). **Jackson County**, near Ashland, granites, 730–850 m, 17 May 1898, *E. I. Applegate* 2155 (US); Queen's Branch, 23 Apr. 1889, *E. W. Hammond* 12 (MO); near Winner, 17 May 1892, *E. W. Hammond* 12 (US). **Jefferson County**, 5 km S of Camp Sherman, near the source of the Metolius River, 16 May 1947, *W. H. Baker* 4055 (CAS). **Klamath County**: 15 km N of Klamath Falls, 21 June 1946, *B. Maquire & A. H. Holmgren* 26523 (US); Crater National Forest, Cascade Mts, 1,280 m, 28 May 1909, *J. P. Rose* 1008 (MO); Swan Lake Valley, Brookside Ranch, 29 May 1897, *E. I. Applegate* 907 (CAS, US). **Lake County**: Crane Creek Mts, 1,980–2,290 m, 17 June 1919, *R. S. Ferris & R. Duthie* 233 (CAS); Morgan Lake Meadow, Q-Hilgard, Ove, 45°17'N, 118°14'W, 6 Mar. 1974, *H. Adams* 74-667-1 (CAS). **Morrow County**, Rock Creek, 1,040 m, 19 May 1894, *J. B. Leiberg* 95 (F, US); up Willow Creek, 28 km SE of Hepper, Blue Mts, N slope, 16 July 1917, *W. M. E. Laurance* 664 (CAS). **Portland**, Siskeou Mts, near Asheand, open hillside, 8 July 1886, *L. F. Henderson* 37 (MO). **Umalilla County**, 30 km N of Ukiah, 1,000 m, 23/26 June 1916, *W. W. Eggleston* 11368 (US). **Union County**, 5 km NW of Elgin, 1,220 m, clearings of pine woods, volcanic rocks, 24 May 2005, *D. Y. Hong, K. Y. Pan & P. Woodward* H05016 (A, BM, CAS, K, MO, PE). **Wallowa County**: Cattle Camp at the head of Horse Creek, 24 June 1897, *E. P. Sheldon* 8347 (MO); Wallowa Mts, near Hat Point, 1 June 1939, *W. C. & M. W. Muenscher* 15848 (MO); 3 km N of Wallowa Town, clearings of pine woods, volcanic rocks, 24 May 2005, *D. Y. Hong, K. Y. Pan & P. Woodward* H05019 (A, BM, K, MO, PE); 5 km N of Wallowa Town, c. 1,700 m, clearings of pine woods, volcanic rocks, 24 May 2005, *D. Y. Hong, K. Y. Pan & P. Woodward* H05020 (PE); Imnaha, Granny View Point, summit, 1,930 m, volcanic rocks, clearings of *Picea* or edges of *Picea* forests, 25 May 2005, *D. Y. Hong, K. Y. Pan & P. Woodward* H05023 (BM, K, MO, PE). **Wasco County**: s. loc., July 1880, *T. J. Howell* s.n. (US); 16 km SE of the Dalles high ridge, 27 May 1928, *J. W. Thompson* 4178 (CAS, MO). **Wheeler County**, near tributary to Service Creek, 20 km S of Fossile, 910 m, 22 June 1950, *A. Cronquist* 6651 (US, W). **UTAH, Box Elder County**, NW of Etna, Goose Creek Mts,

22 May 1997, J. Dixon 802 (US). **San Pete County**, Ephraim Canyon, Manti National Forest, deep clay loam soil, 12 June 1936, B. Crane s.n. (MO). **WASHINGTON, Asotin County**: Blue Mts, 1 June 1937, L. Constance, S. C. Dyal & J. Packard 1870 (US); road to Blue Mts, Anatone, 30 June 1936, R. Downen 102 (MO); Blue Mts, 12 km SE of Anatone, Hudsonian Zone, 30 May 1936, F. G. Meyer 422 (MO); Blue Mts, 1,460 m, 14 May 1949, A. Cronquist 5767 (US). **Chelan County**, Mt Tumwater, 610 m, rocky open slopes, 12 May 1934, J. W. Thompson 10433 (MO, US). **Columbia County**: Blue Mts, Godman Springs, 1,750 m, exposed rocky slope, 19 July 1935, L. Constance, J. F. G. Clarke, W. Staats & G. Van Vleet 1217 (MO); 5 km S of Godman Springs, 1,680 m, dry gravelly soil, 7 May 1927, H. St. John & C. P. Smith 8268 (F). **Kittitas County**: near Cle Elum, sagebrush slopes, 18 May 1935, J. W. Thompson 11510 (CAS, MO); 3 km E of Cle Elum, 24 Apr. 1932, H. C. Cantelow 301 (CAS); 30 km N of Teanaway, 1.5 km below mouth of Stafford Creek, 730 m, in cleared and burned areas, 29 May 1939, C. L. Hitchcock & J. S. Martin 4716 (MO); 3 km SE of Easton, 29 Apr. 1965, D. R. Simpson 236 (F). **Klickitat County**: Falcon Valley, open woods, 20 May 1881 and Sep. 1881, W. N. Suksdorf 13950 (F, MO, US) and 9 May 1910, W. N. Suksdorf 6965 (MO, US); W of Cle Elum, S slope, 2 May 1931, J. W. Thompson 6194 (MO); near Cle Elum, 18 May 1935, J. W. Thompson 1150 (US). **Yakima County**: S fork of Ahtanum Creek, 2 May 1942, R. F. Hoover 5762 (CAS); Wenatchee Mts, Swauk Creek, 910 m, 15 June 1933, R. C. Quik s.n. (CAS). **WYOMING**, s. loc., 25 June 1928, J. C. Murie 202 (US); **Lincoln County**: Jackson's Hole, 2,040 m, 3 Aug. 1920, E. B. & L. B. Payson 2196 (CAS, MO); Grand Teton National Park, near Jenny Lake, 2,130 m, 2 Sep. 1933, L. Williams 1434 (MO); loc. eodem, spring, 1931, A. C. Lyon s.n. (MO).

10. *Paeonia californica* Nutt. ex Torr. & A. Gray, *Fl. N. Amer.* 1: 41 (1838); Huth, *Bot. Jahrb. Syst.* 14(3): 273 (1891); Stebbins, *Madroño* 4(8): 252–260, pl. 37, figs a–e (1938); Stern, *J. Roy. Hort. Soc.* 68: 124 (1943); Stern, *Study Gen. Paeonia*, 53 (1946); Wiggins, *Fl. Baja California*, 777, fig. 757 (1980). *Paeonia brownii* Douglas ex Hook. var. *californica* (Nutt. ex Torr. & A. Gray) Lynch, *J. Roy. Hort. Soc.* 12: 433, fig. 25 (1890). *Paeonia brownii* Douglas ex Hook. subsp. *californica* (Nutt. ex Torr. & A. Gray) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 31 (1997); Halda, *Gen. Paeonia*, 135 (2004). TYPE: USA, California, near St. Barbara, s.d., Nuttall s.n. (lectotype here designated K!; isolectotype BM!).

Paeonia brownii auct. non Douglas ex Hook.: Brewer & Watson, *Bot. Calif.* 1: 13 (1876), pro parte, quoad specim. San Bernardino; Jepson, *Fl. Calif.* 1: 515 (1909); Jepson, *Man. Flower. Pl. Calif.*, 373 (1923); Munz, *Man. S. Calif. Bot.*, 170, fig. 176 (1935).

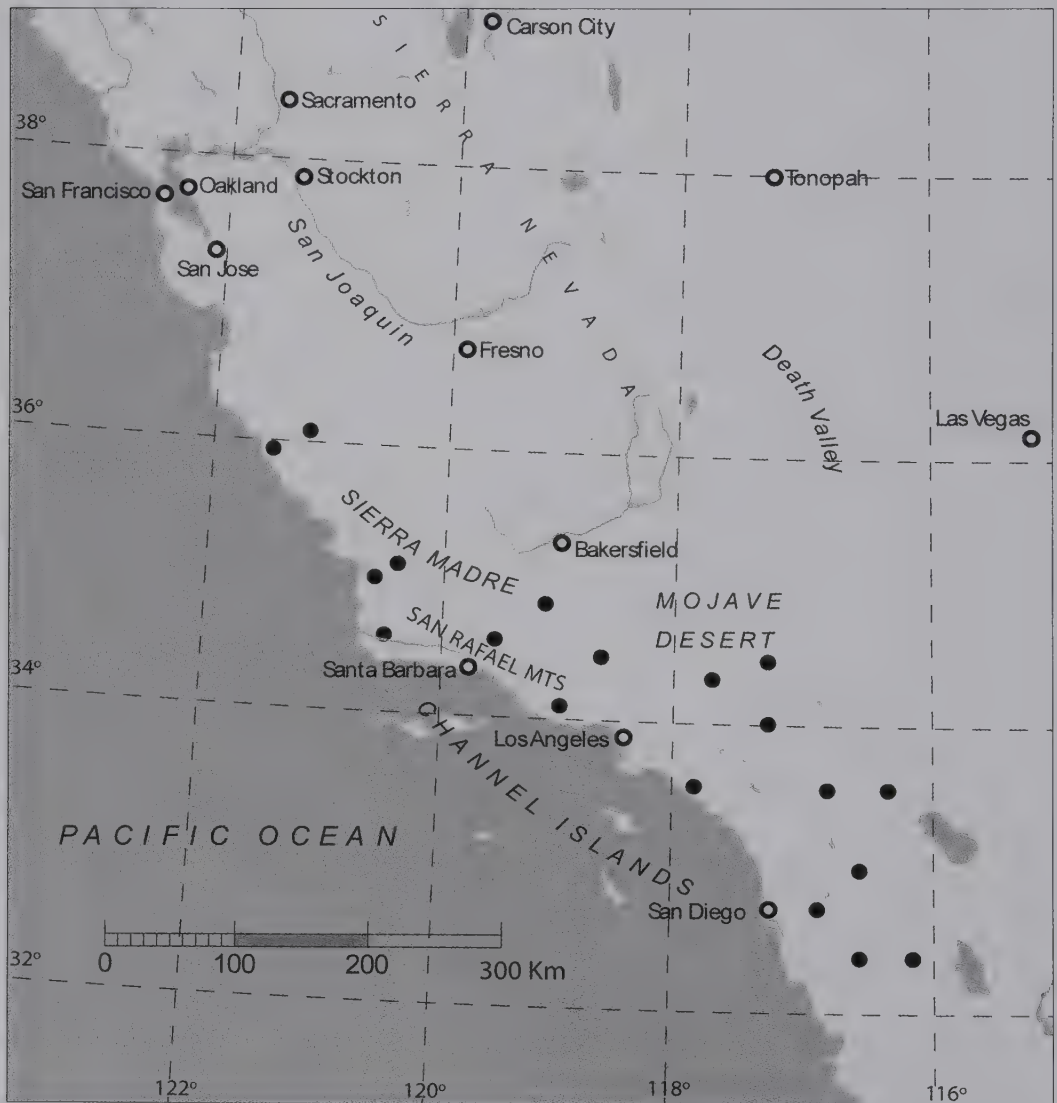
Perennials totally glabrous. Roots slightly fusiform-thickened, up to 3 cm in diameter. Caudex (rhizomes) up to 8 cm long. Stems 40–70 cm tall, entirely green, up to 1.2 cm in diameter, usually with sterile or fertile branches. Lower leaves ternate, very occasionally nearly biternate; petioles 4–13 cm long; leaflets 3 in number, each leaflet with three or several segments, each segment with two or several lobes, rarely entire, segments and/or lobes totalling 33–78 in number; segments 3–8 cm long, 0.4–2.0 cm wide; lobes linear to lanceolate, usually acute, sometimes mucronate at the apex, 0.2–3.0 cm long, 0.2–1.2 cm wide. Flowers terminal, solitary but usually several, up to 6 in number on a stem, pendent; involucre bracts usually 1 or 2 in number, leaf-like; sepals 3 or 4 in number, rounded, green or green but purple at the periphery, or purple, 1.2–2.0 cm long, 1.2–2.0 cm wide, as large as or slightly smaller than petals; petals 6–8 in number, entire, purple, dull dark red, dark purple red or brownish purple, 1.2–2.2 cm long, 1.0–2.0 cm wide; stamens numerous; filaments yellow; anthers yellow; disk fleshy, yellow, dentate, teeth variable in shape, 2.5–6 mm high; carpels 3, less frequently 2, occasionally 4, 5 or 6 in number, glabrous; stigmas sessile, 3 mm long, 2 mm wide, horizontal. Follicles cylindrical, 2.5–4.2 cm long, 1.1–1.7 cm in diameter. Seeds oblong, black, 10–12 mm long, 5.5–6 mm in diameter. Figs 5.10A, 5.10B.

PHENOLOGY. Flowering from January to May, but mostly in March and April; fruiting from June to July.

CHROMOSOME NUMBER. $2n = 10$ (Stebbins & Ellerton, 1939; Walters, 1942, 1952, 1956; Zhang & Sang, 1998).

HABITAT AND DISTRIBUTION. Growing from coastal areas with altitudes of only 30 m to mountain areas with altitudes up to 1,200 m at Corte Madera Ranch, San Diego County. It occurs mostly in chaparral, or openings, or on edges of chaparral and *Quercus* woods, with *Adenostemma fasciculata*, *Erodium crassifolium*, *Eriogonum fasciculata*, *Rhus laurina*, *Salvia mellifera* and *Artemisia californica* most frequently found as associated plants. It prefers dry granite soils. Confined to the northern-most Baja California of Mexico and to S California, USA (Fig. 4.3 and Map 5.10).

NOTES. *Paeonia californica* is recognised as an independent species by most taxonomists. However, Brewer and Watson (1876), Jepson (1909, 1923) and Munz (1935) treated it as synonymous with *P. brownii* Douglas ex Hook., whereas Lynch (1890) reduced it to a variety of *P. brownii*. Stebbins (1938b) clearly documented the distinctness of *P. californica* from *P. brownii*, but Halda (1997, 2004) still recognised the former as a subspecies within the latter. We made field observations and carried



Map 5.10. Distribution of *Paeonia californica* Nutt. ex Torr. & A. Gray.

out population sampling in 2005 in southern California with the assistance of Dr J. Z. Qiu, and in the Blue Mountains guided by Paige Woodward from Canada. We sampled two populations in California and three in Oregon. In addition, we conducted field observation on *P. brownii* in 1999 in Idaho, guided by Dr Jenny Q. Y. Xiao. According to our observations and population samples, the lower leaves of *P. californica* are always ternate, a unique aspect in the genus, whereas they are always biternate in *P. brownii*. The carpels number mostly three (27/34, i.e. 80%), less frequently two, occasionally four, five or six in *P. californica*, but mostly five (29/39, i.e. 74.4%), rarely four, very occasionally six or three in *P. brownii* (Figs 5.9A, 5.10A). The number of final lobes on the lower leaves ranges from 33 to 78 in *P. californica* and 59–110 in *P. brownii*, and these two ranges are statistically discontinuous (Fig. 5.10C1). Our cluster analysis (the unweighted pair-groups method using arithmetic averages, i.e. UPGMA) (Fig. 5.10C2) shows that these two entities are morphologically distinct and should be better treated as two separate species.

ADDITIONAL SPECIMENS EXAMINED. MEXICO, BAJA CALIFORNIA: c. 35 km S of Tecate, rocky valley, oak scrubs, 23 Mar. 1974, J. & C. Taylor 15609 (MO, US); c. 23 km E of Tecate, near road to Mexicali, c. 910 m, 30 June 1962, I. L. Wiggins & J. H. Thomas 430 (CAS, US); c. 5.5 km N of Compadre, along road from Ojos Negros to Tecate, Sierra Pinal, granites, open chaparral of *Adenostemma fasciculata* and *Rhus laurina*, 24 June 1971, I. L. Wiggins 21649 (CAS). **LOWER CALIFORNIA,** Nachognero Valley, 5 June 1894, E. A. Mearns 3498 (US). **USA, CALIFORNIA, Los Angeles:** *s. loc.*, 1880, A. E. Bush s.n. (US); *s. loc.*, 26 Apr. 1939, B. Templeton s.n. (A); *s. loc.*, 340 m, 12 Feb. 1952, E. K. Balls 8191 (A); *s. loc.*, 25 Jan. 1897, M. S. Snyder s.n. (F); *s. loc.*, Feb. 1887, H. E. Hasse s.n. (F); Altadena, 400 m, 7 Jan. 1937, H. J. Ramsey 371 (A); *loc. eodem*, 400 m, 7 June 1937, H. J. Ramsey 372 (A); *loc. eodem*, 5 Mar. 1938, H. J. Ramsey 2723 (A); Benedict Canyon, under trees, 29 Feb. 1936, R. M. Perkins 97 (A); Canyon Glendora Foothills, dry foothill, 10 Feb. 1929, E. Crow 151 (A); NW of Chatsworth, Southern Oak Woodland, 300 m, 4 Apr. 1969, D. A. Young P310 (A); Hills, 23 Feb. 1914, G. L. Moxley 209 (A); Japanga Canyon, hillside, 3 Mar. 1929, T. Clare s.n. (A); Liebre Mts, Cienaga Canyon, 34°41'N, 118°40'W, 980–1,060 m, 25 Mar. 1997, S. Boyd & Lauren Raz 9273 (CAS); Newhall, 460 m, 19 Apr. 1949, N. C. Cooper 3623 (A); Pasadena, N of Eagle Park, 34°09'N, 118°13'W, 300 m, 9 Mar. 1957, J. H. Thomas 6496 (CAS); Pasadena, Arroyo Seco at the Devil's Gate, 14 Feb. 1925, M. B. Peirson 5434 (A); Eagle Rock, 220 m, 23 Apr. 1912, H. H. Smith 4811 (F); Pomona, San Jose Hills, 300 m, 3 Mar. 1932, L. C. Wheeler 452 (A, CAS); Santa Anita Canyon, Sierra Madre, hillside, 13 Jan. 1929, C. Brown s.n. (A); San Dimas Canyon, 550 m, flowers wine red, 2 Apr. 1943, S. Jyson s.n. (A); San Gabriel Mts, Sunset Ridge, by Millard Canyon, 23 Apr. 1967, L. C. Wheeler 9189 (F); San Gabriel Mts, Limekiln Canyon, 30 Apr. 1967, L. C. Wheeler 9226 (F); Santa Monica Mts, Mundeville Canyon, 120 m, 12 May 1932, L. C. Wheeler 477 (A); *loc. eodem*, 425 m, Apr. 1929, I. W. Clokey & B. Templeton 4447 (A, F); Santa Monica Mts, Malibu State Park, chaparral trail, 300 m, 25 Feb. 1995, C. A. Mish 6 (MO); *loc. eodem*, 700 m, 28 May 1944, McCulloch s.n. (A); Santa Monica Mts, Malibu Creek, 34°06'N, 118°43'W, 340 m, 5 May 1959, P. H. Raven & H. J. Thompson s.n. (A); Santa Monica Mts, Saddle Rock Ranch, near Seminole Hot Springs, 7 May 1964, P. H. Raven & R. F. Thorne 19026 (A); Santa Monica Mts, Sepulveda, 11 Mar. 1902, L. R. Abrams 3112 (F); Angeles National Forest, c. 900 m, foothill, granite, grasses with sparse shrubs, 22 May 2005, D. Y. Hong, K. Y. Pan & J. Z. Qiu H05012 (A, BM, CAS, K, MO, PE). **Monterey County:** Santa Lucia Mts, 580 m, 3 Feb. 1951, K. L. Chambers 004 (CAS); Santa Lucia Mts, Feb. 1898, R. A. Plaskett s.n. (US); Santa Lucia Mts, N of Gamboa Point, 240 m, coastal scrubs, 31 Jan. 1982, C. Genetii & E. Engles 1 (CAS); Santa Lucia Mts, San Antonia Valley, 380 m, 7 Apr. 1962, D. E. Breedlove 2158 (CAS). **Orange County:** Rancho Santa Ana, Santa Ana River, 6 June 1927, J. T. Howell 50 (A); near San Juan Camp, 21 Apr. 1948, *s. coll.*, s.n. (A); Santa Ana Canyon, Santa Ana River, 150 m, 6 June 1927, J. T. Howell 2450 (CAS); Santa Ana Mts, Trabuco Canyon,



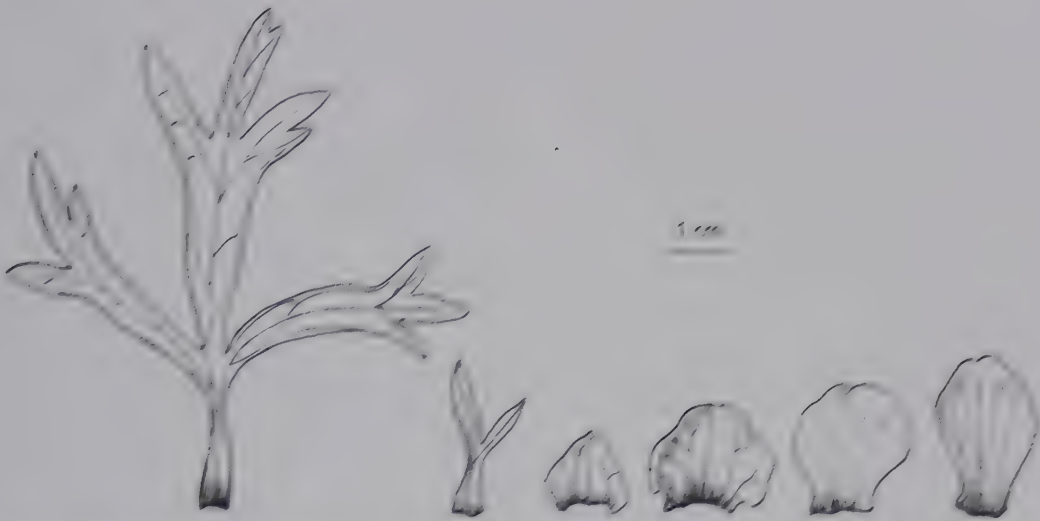


Fig. 5.10B. *Paeonia californica* Nutt. ex Torr. & A. Gray: involucrate bracts and sepals, based on D. Y. Hong, K. Y. Pan & J. Z. Xu H05011 (RM, K, MO, PE). Drawn by Miss Li Ai-Li.

0.75 km above Trabuco oaks, 460 m, 6 Mar. 1931, C. B. Wolf 1842 (A, CAS); Santa Ana Mts, near Sierra Peak, Clay Mine Canyon, 210 m, 6 Feb. 1928, J. T. Howell 809 (A); Santa Ana Mts, below San Juan Hot Springs, 180 m, in open *Quercus* woods, 17 Jan. 1936, C. B. Wolf 7949 (A, MO); Santa Ana Mts, near Irvine Lake, 800 m, 4 Mar. 1958, Olmsted 19 (A). **Riverside County:** riverside and vicinity, 13 Mar. 1907, F. M. Reed 1259 (F); E of Aguanga, under *Adenostemma sparsifolium*, 29 Apr. 1922, P. A. Munz 5112 (A); 4 km N of Clehuz, Richman Ranch, 610 m, 20 Mar. 1932, D. P. Wolf 19 (A); Agua Tibia Mts, 430 m, chaparral, 2 May 1996, D. L. & E. H. Banks 9932 (F); Agua Tibia Mts, 390–410 m, oak woodlands, 5 Feb. 1997, D. L. Banks & J. Moreno 1260 (F); near NE border of Cleveland National Forest, 900 m, 33°39'N, 117°24'W, 2 May 1992, J. S. Miller, M. Merello & A. Pool 7458 (MO); SE of Corona, near margin of Cleveland National Forest, 19 Mar. 1972, T. Robert & Schlisling 3013 (MO); Elinore, 27 km W, on border of forests and prairie woodlands, 26 June 1959, E. W. Lathrop 4361 (A); Elinore, Los Alamos Canyon, open meadows, 760 m, 5 Apr. 1947, N. C. Cooper 2025 (A); Hemet, 5 Apr. 1933, M. E. Jones s.n. (A); Hemet, summit of HWY 79, 760 m, 25 Mar. 1945, M. V. Hood, s.n. (A); near Jacinto, 410 m, sandy loam, grassy ridge, 1 Apr. 1977, C. Davidson 1895 (A); Murrieta, 12 km W, 4 Apr. 1965, E. W. Lathrop 5636 (A); Murrieta, 4 km S, 340 m, grassy slope, 11 Apr. 1979, C. W. Tilforth & W. Wisura 1770 (A); Pamona, 25 Mar. 1932, T. H. Halmes s.n. (A); Santa Ana Mts, 610 m, granites, 17 Jan. 1936, C. B. Wolf 2593 (A); Santa Ana Mts, Skyline Drive, 6 km W of Corona Tin Mine Canyon, 310 m, 23 Mar. 1966, E. W. Lathrop 6077 (A); Santa Rosa Plateau, c. 15 km SW of Murrieta, 10 Feb. 1972, C. Wainwright & L. DeHohr 594 (A); Santa Rosa Plateau, Rancho California, 610 m, 5 June 1969, R. F. Thorne & E. W. Lathrop 33329 (CAS); Temecula Grade, 550 m, 26 May 1932, L. Benson 3178 (A). **San Bernardino County:** s. loc., Apr. 1861, S. B. & W. F. Parish 37 (F); s. loc., Apr. 1891, S. B. Parish s.n. (F); Cajon Wash, 400 m, 11 Feb. 1934, J. B. Edge s.n. (A); 4.5 km S of

Fig. 5.10A (opposite). *Paeonia californica* Nutt. ex Torr. & A. Gray: a, the lower part of the plant, showing slightly fusiform roots; b, the upper part of the plant and a flower with petals and stamens shed, showing the fan-shaped disk and carpels; c, a lower leaf; d, a flower, showing sepals and petals equal in size. Drawn by Miss Li Ai-Li.

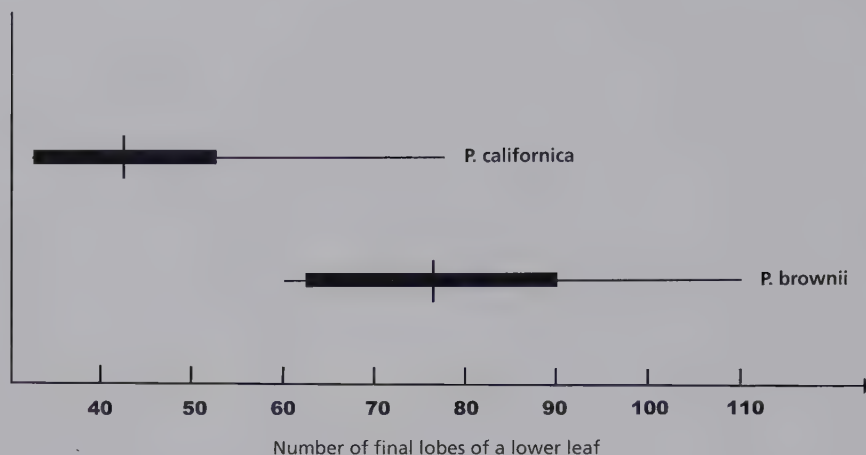


Fig. 5.10C1. Number of final lobes of a lower leaf, showing statistically discontinuous variation in this character (mean (vertical line) and standard deviation (thick bar)).

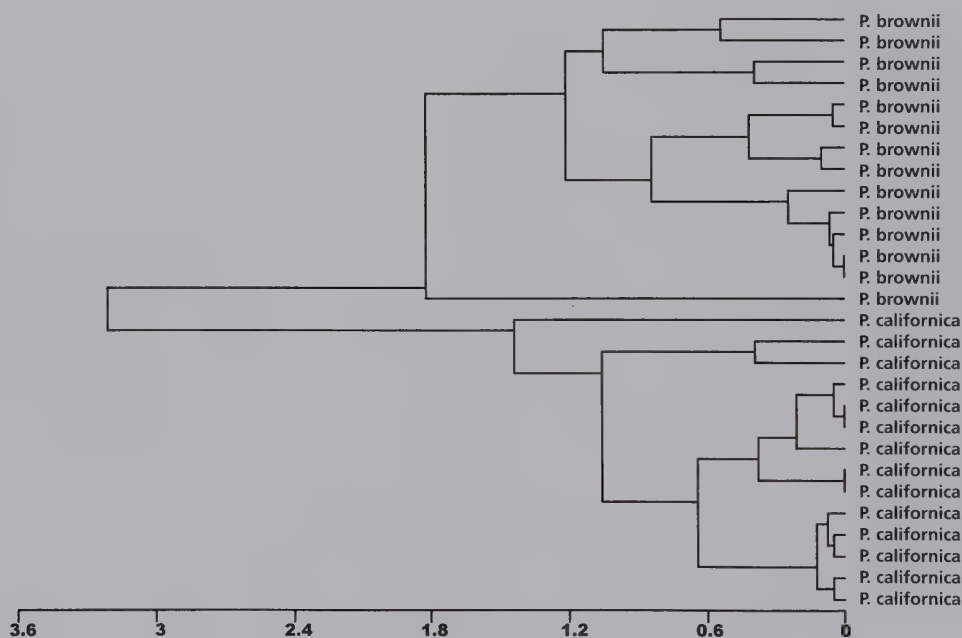


Fig. 5.10C2. Cluster analysis (UPGMA). Each individual was treated as an OUT, and three characters were used: pattern of lower leaves (binate or ternate), number of final lobes of a lower leaf, and number of carpels.

Devore, 11 May 1955, *A. Menke* s.n. (A); San Bernardino Mts, Mill Creek Delta, 15 Mar. 1941, *J. Roos* 217 (A); San Bernardino Valley, 360–400 m, 16 Apr. 1918, *S. B. Parish* 11713 (A, MO); San Bernardino National Forest, Lytle Creek, valley, c. 600 m, granites, chaparral, 21 May 2005, *D. Y. Hong, K. Y. Pan & J. Z. Qiu* H05011 (A, BM, CAS, K, MO, P, PE); San Gabriel Mts, Alta Loma, 530 m, sandy loam, 10 May 1962, *M. Parratt* 121 (A); San Gabriel Mts, Bajada, E side of Etiwanda Creek, 34°08'N, 117°31'W, 440 m, 12 Mar. 1998, *A. C. Sanders* 21703 (CAS);

San Gabriel Mts, NE of Claremont, Evey Canyon, foothills, 9 June 1937, *P. C. Foster* 354 (MO); San Gabriel Mts, Evey Canyon, 0.5 km from the canyon mouth, 740 m, 4 May 1973, *D. R. Bissing* 56 (A); San Gabriel Mts, Johnson's Pastures, 550 m, 2 Apr. 1971, *R. F. Thorne* 41429 (A); *loc. eodem*, above Claremont, 610 m, 23 May 1980, *R. F. Thorne* 54010 (A); *loc. eodem*, 370 m, 26 Mar. 1973, *R. F. Thorne* 42717 (A); San Gabriel Mts, San Bernardino National Forest, W of Cucamonga Canyon, in chaparral, 14 Mar. 1967, *R. F. Thorne & R. Carolin* 41623 (A, MO); *loc. eodem*, between Cajon Campground and Lost Lake, 26 Apr. 1976, *J. R. Shevock* 5008 (A); *loc. eodem*, near Lost Lake, lower part of Long Pine Canyon, 850 m, 26 Jan. 1969, *R. F. Thorne & C. W. Tilforth* 38176 (A); *loc. eodem*, 20 May 1970, *L. C. Wheeler* s.n. (F); E end of San Gabriel Mts, Lone Pine Canyon, Lost Lake, 840 m, 23 Mar. 1991, *T. Ross & S. Boyd* 4237 (CAS); San Gabriel Mts, Little Tujunga Canyon, edges of chaparral, 8 June 1975, *L. C. Wheeler* s.n. (F). **San Diego:** *s. loc.*, 800 m, 19 May 1958, *E. K. Balls* 11391 (A); Bulzura River Valley, 6 km W of Dulzura, 30 Mar. 1922, *M. C. Wiegand & G. B. Upton* 3264 (F); 4–5.5 km beyond HWY 79 on the Palomar truck trail into Blue Canyon, 1,070–1,130 m, 18 May 1990, *F. Almeda & J. Copp* 6560 (CAS); 3 km W of Boulevard, 8 Apr. 1940, *C. L. Hitchcock* 5995 (A, MO); 7.5 km W of Campo, 2 Apr. 1949, *R. L. Dressler* 555 (A); Campo, open places in chaparral, 25 May 1903, *L. R. Abrams* 3601 (CAS); 18 km E of Campos on Hwy 94, chaparral with *Quercus*, *Cercocarpus*, *Adenostemma*, etc., 28 May 1993, *L. R. Landrum* 7820 (F); Cleveland, 1,160 m, 1 Apr. 1969, *R. K. Gierish & D. H. Esplin* 3393 (CAS); Agua Tibia Mts, Cleveland National Forest, 33°24'N, 116°55'W, 1,050 m, 13 Apr. 1997, *D. L. Banks & V. Steinmann* 1902 (F); Corte Madera Ranch, near Pine Valley, 1,200 m, 9–10 May 1993, *H. van der Werff* 12946 (MO); S of Cuyamaca State Park, open hillside, 18 May 1935, *E. A. Purer* 6618 (CAS, MO); Pala Grade, 1924, *E. C. Jaeger* s.n. (A); below Descanso, on grade, 21 Feb. 1926, *I. L. Wiggins* 1855 (CAS); J. R. Hoover Ranch, 6 km SE of Fallbrook, 80–170 m, granites, open chaparral, 5 Mar. 1966, *D. H. Hoover* s.n. (CAS); Japatul Valley, 25 Mar. 1932, *E. Purer & F. Detmers* 16362 (A); S of Laguna Recreation Area, 7.5 km N of U. S. Interstate 8, 19 Apr. 1962, *A. Harrison* 35 (A); N of Lake Hodges, 4 June 1933, *E. A. Purer* 5022 (A); Moreno Dam, 14 Apr. 1927, *I. L. Wiggins* 2377 (CAS); Paway Road, 20 Apr. 1913, *A. Eastwood* 2852 (CAS); 4 km SE of Riverside–San Diego county line, State Hwy 79, sandy gravel, chaparral, 19 Apr. 1958, *E. K. Balls & P. C. Everett* 22874 (A); above Sweetwater River, Cuyamaca, 610 m, 1 Apr. 1933, *L. Benson* 4276 (A); near Warner Hot Springs, 6 Apr. 1929, *O. M. Clark* 1963 (A). **San Luis Obispo County:** near Cambria, 7 Apr. 1949, *R. Bacigalupi* 3077 (US, W); La Panza Range, Pozo Road, E of Pozo, summit, 16 Apr. 2000, *M. Menke* 89 (CAS); La Panza Range, 3 km NE of Pozo, above Pozo Greek, 460 m, 22 Apr. 1940, *L. Constance & A. A. Beetle* 2532 (CAS); Morro Sands, 29 July 1927, *A. Eastwood* 14957 (CAS); Santa Lucia Range, near summit of Mt Lime, 590 m, 18 Feb. 1956, *E. C. Twisselman* 2511 (CAS); Santa Ysabel Ranch, E side of Salinas River, c. 8 km S of Paso Robles, 24 Apr. 1969, *E. C. Twisselman* 15167 (CAS). **Santa Barbara County:** amid, low brushes, 21 Apr. 1908, *A. Eastwood* s.n. (F); Bates Canyon Public Camp, c. 30 km SW of New Cuyama, oak woodlands, 4 May 1963, *J. Turner, F. M. Ball & C. Blake* 1293 (A); Happy Valley Canyon, Los Padres National Forest, 34°41'N, 119°41'W, 18 Apr. 2000, *W. Hees, K. Cherwin & W. Shepard* 8955 (F); Jesuisita Trail, between San Rogue and Mission Canyon, c. 305 m, 26 Feb. 1956, *H. M. Pollard* s.n. (CAS); Los Padres National Forest, 450 m, dry hillside, 1 Apr. 1949, *R. Ambrosetti* 3193 (A); San Marcos Pass, 4 Mar. 1929, *A. Eastwood* 16832 (CAS); Mission Canyon, 6 May 1955, *H. M. Pollard*, s.n. (A); Santa Maria, 5 Apr. 1934, *M. E. Jones*, s.n. (A); 8 km S of Surf, base of sandy hills, 14 Apr. 1929, *R. S. Ferris* 7580 (CAS); 6 km S of Surf, upper Sonoran, coastal sand dunes, 30 m, 14 Apr. 1929, *C. B. Wolf* 3514 (A). **Ventura County:** Ojai Valley and vicinity, 12 May 1895, *N. Pettibone & F. W. Hubby* s.n. (CAS); 6 km SE of Ojai, Taft Ranch, top of Mt Sulphur, 850 m, 4 Apr. 1972, *E. McMillan* s.n. (CAS); Sespee Canyon, 13 Mar. 1932, *L. E. Hoffman* s.n. (A).

IIIa. PAEONIA sect. PAEONIA subsect. ALBIFLORAE (Salm-Dyck) D. Y. Hong

(species 11–14)

11. *Paeonia lactiflora* Pall., *Reise russ. Reich.* 3: 286 (1776); Handel-Mazzetti, *Acta Horti Gothob.* 13: 37 (1939); Stern, *Study Gen. Paeonia*, 91 (1946); Fang, *Acta Phytotax. Sin.* 7(4): 320 (1958); Anonymous, *Icon. Cormophyt. Sin.* 1: 653, fig. 1306 (1972); Anonymous, *Fl. herb. bor.-orient.* 3: 89, pl. 36, figs 1–4 (1975); Pan, *Fl. Reip. Pop. Sin.* 27: 51, pl. 7 (1979); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 131. 2001. TYPE: Russia. Siberia: Chitinsky Prov., Nerchinsk, Bergabhängen, 1889, F. Karo 170 (neotype here designated, WU!; isoneotypes E, KI!).

Paeonia lactea Pall., *Reise russ. Reich.* 3: 321 (1776), nom. nud.

Paeonia lactiflora Pall. var. *trichocarpa* (Bunge) Stern, *J. Roy. Hort. Soc.* 68: 129 (1943); Stern, *Study Gen. Paeonia* 93 (1946); Pan, *Fl. Reip. Pop. Sin.* 27: 51 (1979). Basionym: *Paeonia albiflora* Pall. var. *trichocarpa* Bunge, *Enum. Pl. China bor.* 3 (1831), syn. nov. TYPE: China, Inner Mongolia [Nei Mongol], Mt Huanggangliang, edges of forest, July 2004, D. Y. Hong, K. Y. Pan et al. H04040a (neotype here designated: PE!).

Paeonia lactiflora Pall. var. *villosa* M. S. Yan & K. Sun, *Bull. Bot. Res. Harbin* 12(4): 325, fig. 1 (1992), syn. nov. TYPE: China, Gansu: Tianshui, Dongcha, 9 July 1983, Z. Ma 433 (holotype NWNJ, n.v.).

Paeonia albiflora Pall., *Fl. ross.* 92, tab. 84 (1788); Sims, *Bot. Mag.* 42: tab. 1756 (1815); de Candolle, *Syst. nat.* 1: 392 (1818); de Candolle, *Prodr.* 1: 66 (1824); Franchet, *Pl. david.* 1: 23 (1884); Forbes & Hemsley, *J. Linn. Soc. Bot.* 23: 21 (1886); Lynch, *J. Roy. Hort. Soc.* 12: 437 (1890); Huth, *Bot. Jahrb. Syst.* 14: 265 (1891). TYPE: tab. 84 in Pallas, 1788 (holotype tab. 84, Pall., 1788!).

Paeonia albiflora Pall. var. *fragrans* Sabine, *Trans. Hort. Soc. London* 2: 278, tab. 18 (1817); Anderson, *Bot. Reg.*, tab. 485 (1820). *Paeonia fragrans* (Sabine) Redouté, *Choix plus belles fleurs*, tab. P. J. Redouté-22 (1827). TYPE: tab. 18 in Sabine, 1817 (holotype tab. 18, Sabine, 1817!).

Paeonia albiflora Pall. var. *hirta* Regel, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 34: 125 (1861). TYPE: Russia. Primorsky Prov.: Khaitzo, by Ussuri River, 1859, R. K. Maak s.n. (neotype here designated: LE!).

Paeonia albiflora Pall. var. *humei* Sabine in *Trans. Hort. Soc. London* 2: 279 (1817). *Paeonia humei* (Sabine) Vilm., *Fl. pleine terre* edn 3, 892 (1870). TYPE: not designated.

Paeonia albiflora Pall. var. *purpurea* Korsh., *Trudy Glavn. Bot. Sada* 12: 302 (1892). TYPE: not designated.

Paeonia albiflora Pall. var. *spontanea* Makino, *J. Jap. Bot.* 5(9): 33 (1928). TYPE: not designated.

Paeonia albiflora Pall. var. *trichocarpa* Bunge f. *nuda* Nakai, *J. Jap. Bot.* 13(6): 393 (1937). *Paeonia lactiflora* Pall. f. *nuda* (Nakai) Kitag., *Neo-Lin. fl. manshur.*, 302 (1979) syn. nov. TYPE: Korea, Kanhoku, Mt Mozanrei, 9 June 1909, T. Nakai s.n. (holotype TII!).

Paeonia albiflora Pall. var. *trichocarpa* Bunge f. *pilosella* Nakai, *J. Jap. Bot.* 13(6): 393 (1937). *Paeonia lactiflora* Pall. f. *pilosella* (Nakai) Kitag., *Neo-Lin. fl. manshur.*, 303 (1979) syn. nov. TYPE: Korea, Keiki, Kōryo, 6 May 1935, Tei s.n. (holotype TII!).

Paeonia albiflora Pall. var. *typica* Huth, *Bot. Jahrb. Syst.* 14: 265 (1891).

Paeonia albiflora Pall. var. *typica* Huth f. *genuina* & *pilifera* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2 (11–12): 44 (1921), syn. nov. TYPE: not designated.

Paeonia albiflora Pall. var. *whitleyi* Sabine, *Trans. Hort. Soc. London* 2: 277 (1817); Anderson, *Trans. Linn. Soc. London* 12: 259 (1818). *Paeonia whitleyi* (Sabine) Hort ex Garden in *Garden* 36: 8, cum tab. (1889).

Paeonia chinensis Hort ex Vilm., *Fl. pleine terre* edn 3: 892 (1870) in syn. sub *P. albiflora*.

Paeonia edulis Salisb. in Hooker (ed.): *Parad. lond.* tab. 78 (1805). *Paeonia albiflora* Pall. var. *edulis* (Salisb.) Pursh in Donn (ed.): *Hortus Cantabrig.* edn 8, 177 (1815). TYPE: Salisbury's tab. cited (holotype!).

Paeonia edulis Salisb. var. *reevesiana* Paxton in *Paxton's Mag. Bot.* 1: 197, cum tab. London (1834).

Paeonia reevesiana (Paxton) Baxter & Wooster, *Suppl. Hort. Brit.*, 601 (1850). TYPE: Paxton's tab. cited (holotype!).

Paeonia edulis Salisb. var. *sinensis* Sims, *Bot. Mag.* 42: tab. 1768 (1815). TYPE: Sims' tab. cited (holotype!).

Paeonia fragrans Redouté, *Choix plus belles fleurs*, tab. P. J. Redouté-22 (1827), err. pro *P. fragrans*. TYPE: tab cited (holotype!).

Paeonia lobata Pall., *Reise* 2: 553 (1773), nom. nud.

Paeonia sinensis Hort ex Steud., *Nomencl. bot.* edn 2, 2: 247 (1841) pro syn. sub *Paeonia albiflora*.

Paeonia yui W. P. Fang, *Acta Phytotax. Sin.* 7(4): 321, pl. 63: 1 (1958). TYPE: Yunnan, Weixi County, "Wei-hsi Hsien, Tao-jao, alt. 3,200 m, cultivated herb", 1 May 1937, T. T. Yü 8223 (holotype KUN!; isotype PE!).

Paeonia officinalis auct. non L.: Thunberg, *Fl. Jap.*, 230 (1784); Loureiro, *Fl. cochinch.* 1: 343 (1790).

Herbs perennial. Roots thick, cylindrical or carrot-shaped, attenuate toward tip, up to 30 cm long, 2 cm in diameter. Stems up to 1 m tall, glabrous, very occasionally hispid. Lower leaves biternate; terminal leaflets often 2- or 3-segmented; leaflets/leaf segments 10–15, rarely 9 in number, lanceolate or ovate-lanceolate, cuneate or decurrent at the base, acute at the apex, 4.5–16 cm long, 1.5–6 cm wide, usually with bristles along veins or sometimes glabrous above, glabrous or sparsely pubescent along veins beneath; margins white cartilaginous-thickened, dentate-spinose on the thickenings. Flowers usually 3–4 on a stem, both terminal and axillary, sometimes only the terminal one developed with 2–3 axillary sterile buds, very rarely solitary without sterile flower buds, single (in wild populations) or double (in cultivated plants), 8–13 cm across; involucre bracts 4 or 5 in number, unequal, leaf-like; sepals 3 or 4 in number, broadly ovate or suborbicular, 1–2 cm long, 1–1.7 cm wide, all caudate at the apex; petals 9–13 in number, white or pink (in wild populations), or various in colour (among cultivated plants), obovate, 3.5–6 cm long, 1.5–4.5 cm wide; filaments yellow; anthers yellow; disk yellow or red, 1–5 mm high, waved or incised; carpels 2–5 in number, green, red or purple, glabrous or rarely sparsely hispid or tomentose, with hairs 1–1.5 mm long; stigmas sessile, red, 1.5–2.5 mm wide. Follicles ovoid or oblong-ellipsoidal, 2.5–3 cm long, 1.2–1.5 cm in diameter. Seeds black, ovoid-spherical, 7 mm long, 6 mm in diameter. Figs 5.11A, 5.11B.

PHENOLOGY. Flowering from May to early July; fruiting from late July to September.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, 1988; Nakamura & Nomoto, 1982; Stern, 1944).

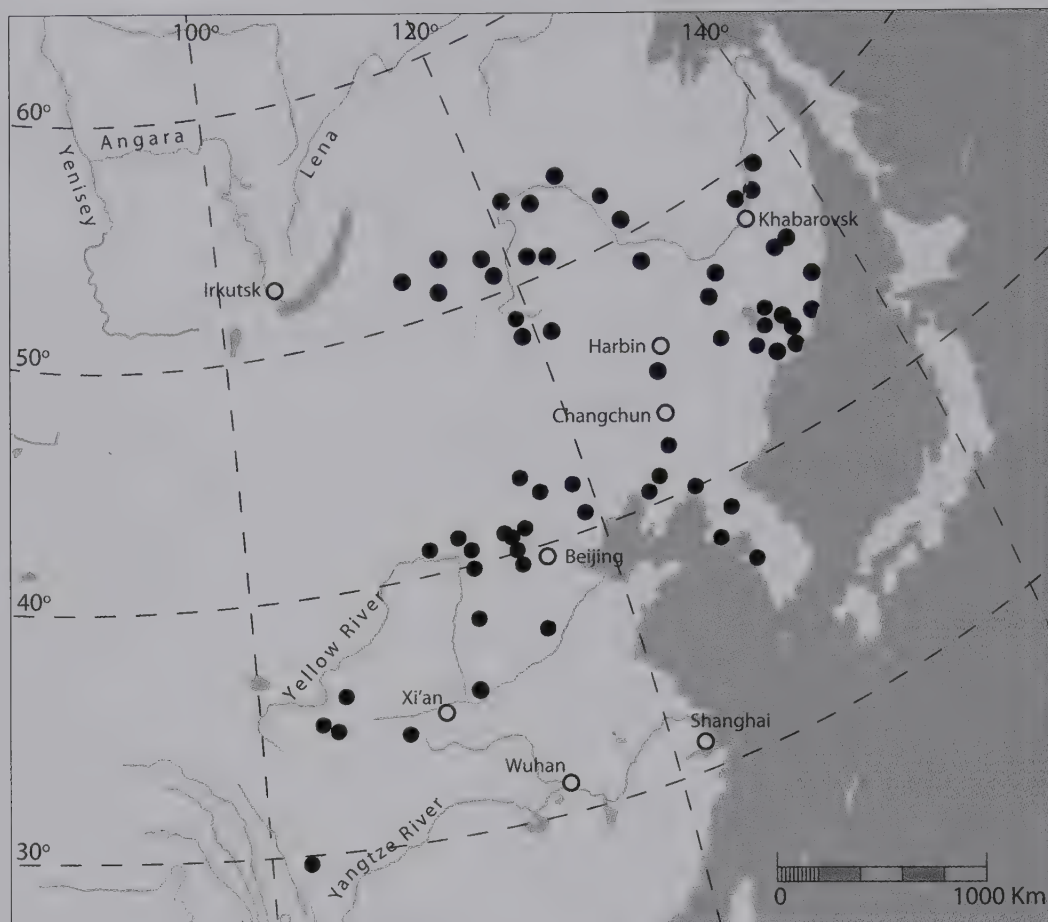
HABITAT AND DISTRIBUTION. Growing in bushes and grasslands, but also in open woods, at altitudes from lowlands to 2,300 m, but to 3,400 m in Sichuan Province (Kangding), China. In E Asia: China, the Korea Peninsula, E Mongolia, and Russia (the Far East and SE Siberia). Map 5.11.

NOTES. The most distinct character of *Paeonia lactiflora* is the cartilaginous thickening along the leaf margins, which are dentate-spinose on these thickenings. Historically, the crossing experiment conducted by Saunders and Stebbins (1938) demonstrated that this species was incompatible with *P. anomala*, *P. veitchii*, *P. emodi*, and four other species, and thus seemed in a very isolated position. However, our unpublished molecular data (*GPAT*, *Adh1* and *Adh2*) imply that the species is closely related to *P. emodi*. In the subsection *Albiflorae*, *P. emodi* and *P. lactiflora* have fewer leaflets/leaf segments.

Petals and carpels in *Paeonia lactiflora* are rather variable in colour in wild populations. The former were found varying from pure white, whitish pink to pink, whereas the latter varied from green, pink, red, purple to dark purple even within a single population (Fig. 3.14). We found both glabrous and pubescent carpels within populations (Figs 3.9, 3.10), and therefore *P. albiflora* var. *trichocarpa* Bunge is here treated as synonymous to *P. lactiflora*.

This species is widely cultivated for both ornamental and medicinal purposes. Flowers are always doubled in cultivated varieties of *Paeonia lactiflora*.

ADDITIONAL SPECIMENS EXAMINED. CHINA, GANSU, Wushan, Tange, Chenjiagou, 2 June 1956, *Huanghe Exped.* 4453 (PE). Zhangxian, Hedcun, 2,200 m, 10 June 1956, *Huanghe Exped.*



Map 5.11. Distribution of wild *Paeonia lactiflora* Pall.

4625 (PE). **HEBEI, Chicheng:** Mt Dahaitou: near the forest farm, 1,240 m, 1 Sep. 1959, *s. coll.* 7367 (PE); behind the forest farm, 10 June 2003, D. Y. Hong, K. Y. Pan & Y. Chen H03002 (PE); opposite the forest farm, 1,300 m, 26 June 2003, D. Y. Hong, K. Y. Pan & Y. Chen H03004 (PE); Jiangzuanzi, 1,300 m, 10 June 2003, D. Y. Hong, K. Y. Pan & Y. Chen H03003 (PE); Sanjianfang, 1,230 m, 16 Sep. 1959, *s. coll.* 7691 (PE). **Longguan:** Zhen'anbao, Zhangjiagou, 1,250 m, 4 Sep. 1959, *s. coll.* 4218 (PE); Zhen'anbao, Zhuanlouwa, 1,250 m, 4 Sep. 1959, *s. coll.* 3964 (PE). **Neiqiu,** Xiaolingdi, Xiaoxitian, 14 Sep. 1951, X. Y. Liu 1158 (PE). **Mt Xiaowutai:** 26 May 1930, H. W. Kung 59 (PE); *loc. eodem*, 1936, Y. Liu 12661 (PE) and 12409 (PE); Daxigou, 2,300 m, 5 July 1959, *Hebei Exped.* A 1158 (PE); Beitai, 8 July 1959, *s. coll.* 10034 (PE); Tienlinsze, 1,100–1,520 m, June 1879, O. V. Mollendorff s.n. (WU). **Yixian:** Guanzuoling, 760 m, 20 May 1934, K. M. Liou 1988 (PE); *loc. eodem*, 8 June 1953, F. Zhao 0231 (PE); Zijinggwan, Junyucun, c. 700 m, 22 May 2003, D. Y. Hong, K. Y. Pan & Y. Chen H03001 (PE). **Zhangbei,** Mt Daqing, 1,760 m, 19 Aug. 1959, *s. coll.* 3509 (PE). **HEILONGJIANG, Mohe,** Tuqiang, Wusuli, 53°30'N, 123°05'E, 250 m, 28 Aug. 2001, Cao & Cheng H01032 (A, K, MO, PE). **Mudanjiang:** 1959, *Wild Plants Survey* 0624 (PE); *loc. eodem*, 1959, *Wild Plants Survey* 0332 (PE); *loc. eodem*, 1959, *Mudanjiang Exped.* 53 (PE). **Nenjiang:** Shuangshan, Jiusan Farm, 21 June 1953, *North-East Exped.* 160 (PE); Jalatun, June 1925, P. H. & J. H. Dorsett 349 (PE). **Yichun:** Beishan, sparse pine woods, 24 July 1956, *Sino-German Exped.* 7692 (PE) and 7693 (PE); Dailing, Dongshan, 11

July 1956, *Sino-German Exped.* 7179 (PE). **HENAN, Huixian**, Mt Guanshan, Qingshibei, c. 1,600 m, 6 May 2007, *D. Y. Hong & K. Y. Pan* H07003 (PE). **JILIN, Da'an**, Longzhao, 11 Sep. 1959, *Baicheng Group* 246 (PE). **O-mu**, Peitayang, 480 m, 8 July 1931, *H. W. Kung* 1769 (PE). **LIAONING, Benxi**, Lianshan Fort, Mt Motianling, *P. Y. Fu & D. C. Zhao* 1285 (PE). **Lingyuan**: Wu'erdeng, Beiyingshi, Daheigou, in forests, 30 June 1959, *S. X. Li* 206 (PE); *loc. eodem*, in thickets, 1959, *S. X. Li* 160 (PE). **Qianshan**: near Liujin Monastery, 280 m, in deciduous forests, 24 May 1998, *D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao* H98016 (A, CAS, K, MO, PE, US); near Mt Longquan, 26 May 1950, *Y. C. Zhu et al.* 439 (PE). **Qingyuan**, Xiajiabao, Xinlitun, granite, sparse woods with thickets, 400 m, 29 May 1998, *D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao* H98032 (A, K, MO, PE). **Shenyang**, in bushes, *C. S. Wang et al.* 1086 (PE). **NEI MONGOL (INNER MONGOLIA), Abagnar Qi (Xilinhote)**: Xilin Gol Nature Reserve, edges of *Populus-Betula* forests, 15 July 2002, *Inner Mongolia Univ.* 96 (HIMC); Diyanmiao Forest Farm, 1,200 m, 25 June 1992, *C. Z. Liang* 92-223 (HIMC) and 92-296 (HIMC). **Bairi Zuoqi**, Baiyinwula, Shipenggou, edges of forests, 12 July 1991, *W. Wang* 560 (HIMC). **Da Hinggan Ling Mts**, Alihe, 8 Aug. 1962, *T. C. Zhu* 698 (PE). **Daqingshan Mts**: W of Laoyo Temple, 1,600 m, 4 Aug. 1956, *S. M. Wu* 269 (PE); Hongzhao, 1 July 1993, *Inner Mongolia Univ.* 93-53 (HIMC); Xiaojingou Valley, c. 1,600 m, edges of *Betula* forests, *Corylopsis-Spiraea* thickets, granites, 2 July 2004, *D. Y. Hong, K. Y. Pan & R. Cao* H04037 (A, BM, CAS, K, MO, PE). **Duolun**, 29 Aug. 1949, *Y. W. Tsui* 820 (PE). **Ergun Qi**, near Ergun, 600-650 m, 16 Aug. 1951, *Z. Wang* 1998 (PE). **Hexigten Qi (Jingpeng)**: 1,500 m, 4 Sep. 1953, *X. G. Hu* 522 (PE); Mt Huanggangliang, edges of forests, 26 June 1991, *C. Z. Liang* 108 (HIMC); *loc. eodem*, 24 Aug. 1991, *C. Z. Liang* 966 (HIMC); *loc. eodem*, 25 Aug. 1991, *C. Z. Liang* 1054 (HIMC); *loc. eodem*, 22 July 1985, *Materia Medic. Exped.* 86 (HIMC); *loc. eodem*, *Nei Monggol Univ.* (*Q. R. Wu*), s.n. (HIMC); *loc. eodem*, July 2004, *D. Y. Hong & K. Y. Pan et al.* H04040 (A, BM, K, MO, PE). **Hulun Buir Meng**, *s. loc.*, 17 June 1963, *Nei Mongol Exped.* 111 (PE). **Solon**: 11 June 1950, *M. Kitagawa & P. Y. Fu* 189 (PE); Honghua'erji, 17 Aug. 1956, *Sino-German Exped.* 8257 (PE). **Wula Mts**, Mt Dahubei, 14 July 1984, *Inner Mongolia Univ. Exped.* 73 (HIMC). **Zhuozhi County**, Shanggaotai, *Prunus sibirica* thickets, 11 July 1998, *C. B. Hao* 3067 (HIMC). **NINGXIA, Guyuan**, Chenjiashan, mountain slope, 14 Aug. 1956, *Acad. Sin. Huanghe Exped.* s.n. (PE). **Jingyuan**, Dananchuan, 2,300 m, in forest, 30 July 1964, *Jing* 0059 (PE). **SHAANXI, Mt Huanglong**, Baichengqiao, 26 Aug. 1939, *K. T. Fu* 3411 (PE). **Mt Taibai**: Dadian, 2,100 m, 30 Aug. 1937, *T. N. Liou & P. C. Tsoong* 491 (PE); near Ping'an Temple, 19 July 1938, *T. N. Liou & P. C. Tsoong* 2486 (PE). **SHANXI, s. loc.**, 24 June 1925, *P. Licent* 7586 (PE). **Mt Guandi**, Nangou, 1,700 m, 26 June 1957, *Huanghe Exped.* 1015 (PE). **Jiaocheng**, Hengjian, 1,700 m, 2 June 1929, *W. Y. Hsia* 1111 (PE). **Mt Lingkong**, Hetaoshan, 15 June 1959, *Kuan & Chen* 711 (PE). **Pinglu**, from Pinglu Town to Dacaping, 8 Aug. 1953, *Shanxi Exped.* 496 (PE). **Xiaxian**, Sijiao, Taikuanhe, Hanyagou, 1 July 1962, *T. W. Liu* 427 (PE). **SICHUAN, Kangding**, Zhonggu Village, 3,400 m, 23 July 1963, *K. C. Kuan, W. T. Wang et al.* 272 (PE). **KOREA, Chungnam**, Manri-Po, 13 Aug. 1981, *T. H. Chung* s.n. (SNU). **Gyeonggye**, Kwangreung, 11 June 1936, *T. H. Chung* 10003 (SNU). **Hwanghae**: Seoheung, 28 May 1933, *B. S. To* 2234 (SNU); *loc. eodem*, 15 July 1933, *B. S. To & H. T. Shim* s.n. (SNU); Haeju, May 1917, *B. S. To* s.n. (SNU); *s. loc.*, *B. S. To & H. T. Shim* s.n. (SNU). **Kannan**, Genzan, 9 June 1909, *T. Nakai* s.n. (TI). **Pyeongbuk**, Euju, 2 June 1922, *B. S. To* 10012 (SNU). **MONGOLIA, E MONGOLIA**: Eastern Ajmak, Khuntu, 35 km ESE of Bain Tzagan, steppe, 6 Aug. 1949, *A. Yunatov* 13148 (LE); Khuntu, 4-5 km SW of Khalzage-Ula and 2-3 km SW of Nurmuryk-Gol, meadows, 8 Aug. 1949, *A. Yunatov* 12177 (LE); Khalkha Valley, watershed of Dehgeh and Nomrog Rivers, shrubs with *Populus* and *Betula*, 27 Aug. 1963, *B. Dashnyam*, s.n. (LE); Khalkha Valley, Numergin-Gol, ravine with *Ulmus* and *Spiraea*, 24 June 1975, *O. Zhurba* 252 (LE); Khalkha Valley, left bank, near Mt Dehrkhin-Tzagan-Obo, 915 m, N slope, rich meadow steppes, 16 Aug. 1970, *V. I. Grubov*,

N. Ulzikhutag & *G. Tzehrehnbalzhid* 710 (LE); Khalkha Valley, Mt Turban Chilotab, 25 June 1925, *V. Kazakevich* 601 (LE); Khalkha Valley, Tori Tzagan Nuru, 27 June 1925, *V. Kazakevich* 672 (LE); Khalkha Valley, Mt Gurban Chingileh Dzun-Udzolin Khan Chindochat Ula, 25 June 1925, *V. Kazakevich* 683 (LE); lower reaches of Numurgin River, left bank, tall-grass meadow, 980 m, 17 Aug. 1970, *V. I. Grubov*, *N. Ulzikhutag* & *G. Tzehrehnbalzhid* 787 (LE); Mt Khavirga-Ula, Numrehgijn River, right bank, 90 km SE of Khamar-Daba Village, *Carex*-grass rich steppes, N slope, 28 July 1970, *Z. V. Karamysheva* & *I. N. Safronova* 1270 (LE). **RUSSIA, AMURSKAYA:** Amur Valley and Sutar River Valley, 1909, *Petrowsky*, s.n. (LE); Amur Valley, summer, 1915, *A. S. Plakhtij* s.n. (LE). **Amuro-Bureinskaya lowlands**, near Kuprijanovka Village, swamp-meadows, 13 June 1914, *A. Krisstofovich* 132 (LE), 133 (LE), 134 (LE), 135 (LE) and 136 (LE). Amuro-Zejskoje Plato: Belaya Basin, 20 km from Novostepanovka Village, oak scrubs, 30 June 1959, *V. Lipatova*, *O. Martjanov* & *K. Pechnikova* s.n. (LE); *loc. eodem*, between Novostepanovka and Simonovo Villages, in *Quercus* bushes, 24 June 1958, *V. Lipatova* & *I. Petrova* s.n. (LE); *loc. eodem*, black-birch forests with *Quercus*, 23 June 1958, *V. Lipatova* & *I. Petrova* s.n. (LE); NW from Kumary, steppe slope toward Amur, 16 June 1958, *T. I. Isachenko*, *S. A. Pivnik* & *G. D. Samarina* 65 (LE); left bank of Amur, 4 km E of Novo-Voskresenovka, S steppe slopes, 18 June 1957, *G. A. Abrosimova* & *A. E. Matzenko* 233 (LE). Babstova Station, oak woods, 28 May 1891, *S. Korshinsky* s.n. (LE). Bidzhan Village (middle Amur), oak woods, 4–12 June 1891, *S. Korshinsky* s.n. (LE). Biro-Bidzhan, Pompeevka Valley, grass-bushy meadows, 17 June 1933, *S. I. Danilov* s.n. (LE); Biro-Bidzhan, Pompeevka Valley, meadows with *Lespedeza* and *Corylus*, 23 Aug. 1932, *S. I. Danilov* s.n. (LE). **Blagoveshchensk:** in Gebuschen, July 1898, *F. Karo* 142 (K); in thickets, common, 20 June 1904, *F. Karo* 3 (LE); near Blagoveshchensk, in bushes, 24 Aug. 1927, *V. Malyshev* s.n. (LE); meadows in forests, June 1903, *F. Karo*, s.n. (LE); *loc. eodem*, June 1904, *F. Karo* 67 (LE). 30 km from Blagoveshchensk, 50°13'N, 127°53'E, 160 m, 1 July 1925, *L. Ludwig* 804 (LE); steep slopes near Ignashina Station, 20 June 1908, *S. Tulajkof* & *B. Dolgopolof* 141 (LE); Dzhalinda Nevchir Valley, 15 June 1912, *A. Taskin* s.n. (LE); between Dzhalinda and Bureja Rivers, left bank of Amur River, near fields of farmstead Beketovo, 21 June 1910, *T. W. Sokolov* 286 (LE); *loc. eodem*, slope on right bank of Uldushchi River, 9 June 1910, *T. W. Sokolov* 156 (LE); Zee-Burejinsky District, Bakhareva Village on Bureja, May 1910, *M. Korotky* 701 (LE); *loc. eodem*, dry pastures, 12 June 1910, *M. Korotky* 706 (LE); Chernyaev, 20 June 1903, *Mansuttod* 96 (LE); near Ivanovskoje Village (between Zeja and Bureja), meadows in *Corylus* bushes, 11 June 1891, *S. Korshinsky* s.n. (LE). Bureja Village, S slopes, 12 June 1916, *N. Bykov* 8 (LE). Near Kumary Village, Amur Basin, cliff, birch-oak woods, 19 June 1959, *V. Lipatova*, *O. Martjanov* & *K. Pechnikova* s.n. (LE); Ostankino Village, high bank of Bureja River, 20 Aug. 1909, *B. A. Fedtschenko* 540 (LE); Radde, Kochkovka Valley, dry meadows, flowering from 10 June to 5 July, 26 June 1927, *V. P. Popova* s.n. (LE); Stolbovskoi Village (S fork of Amur), on mountain slopes, 18 June 1891, *S. Korzhinski* s.n. (LE). Tolbuzina, 31 July 1929, *V. D. Prinada* 82 (LE); near Tolbuzina, on dry slopes, 29 May 1910, *E. A. Stoyanov* 167 (LE); Ust'-Strelka, sunny slopes, 12 June 1859, *Maximowicz*, s.n. (LE); Urkan Valley, meadows, *I. T. Kryukov* 1107 (LE); Zeja River, below mouth of Selemdzha River, dry meadow valleys, slopes, 1910, *P. B. Ripas* s.n. (LE). **CHITINSKY:** 2 km from Alekzavod Village, mountain slopes, in bushes, 22 July 1977, *Makov* s.n. (LE); Watershed of Shilka and Cherny Uryum Rivers, the mouth of Chernaya River, 11 Aug. 1909, *N. V. Blagoveshchensky* & *G. I. Poplavskaya* 1566 (LE); stony slopes, 8 June 1909, *N. V. Blagoveshchensky* & *G. I. Poplavskaya* 244 (LE). Argun Basin, near

Fig. 5.11A (opposite). *Paeonia lactiflora* Pall.: **a**, the lower part of the plant, showing carrot-shaped roots; **b**, the upper part of the plant, a cyme; **c**, a lower leaf; **d**, the leaf margin, showing cartilaginous thickening with spinules; **e**, the upper surface of a leaf, showing bristles along veins. Drawn by Miss LI Ai-Li.



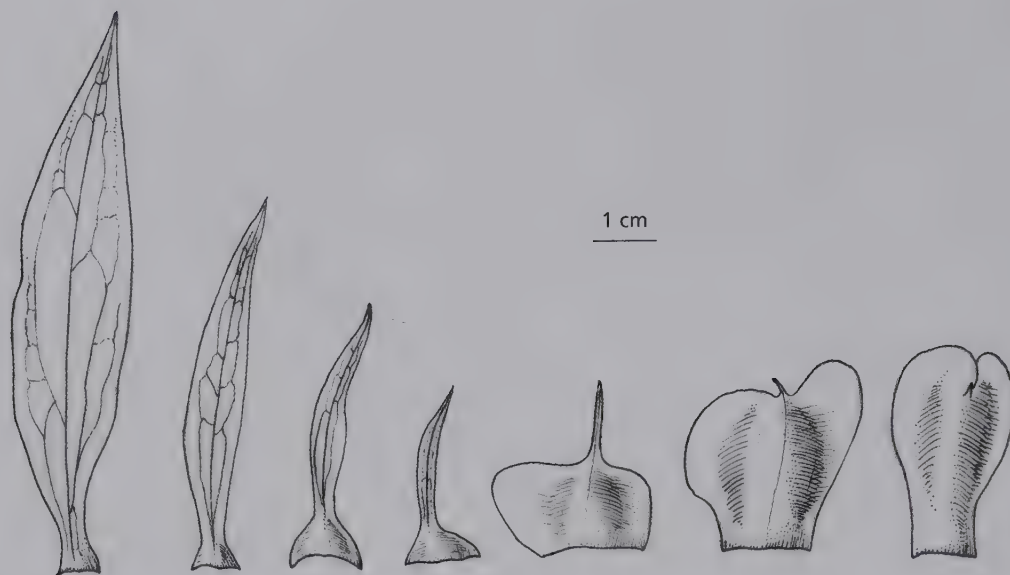


Fig. 5.11B. *Paeonia lactiflora* Pall.: involucrate bracts and sepals, based on D. Y. Hong, K. Y. Pan & R. Cao H04037 (A, CAS, K, MO, PE). Drawn by Mr SUN Yin-Bao.

Soktuevsky Village, Mt Naehn-Tologoi, steppes, 14 Aug. 1911, V. Smirnov 5394 (LE); Urova Valley, near Talakan Village, 1 Aug. 1909, I. M. Krasheninnikov 247 (LE); sunny slopes, 17 Aug. 1909, I. M. Krasheninnikov 1075 (LE). Near Chita, stony slopes, 18 June 1911, T. Gromova s.n. (LE); near Gazimursky Zavod Village, S slopes, 25–26 June 1962, L. I. Sergievskaya s.n. (LE); Kurenga, slopes near the mouth of Areda, 13 Aug. 1908, I. Novopokrovsky s.n. (LE); Kurenga Railway Station, 11 June 1911, Koshikova s.n. (LE); Makoveevskije mineral springs, in woodlands, clearings, 15 June 1910, P. S. Mikhno s.n. (LE); Mt Naen-Tologoi, 18 July 1930, M. Ivanova 148 (LE). Nerchinsk, the mouth of Kurenga River, right confluence of Shilka River, 15 June 1912, E. Zhukova s.n. (LE); near Nerchinsk, mountain slopes, June–July 1892, Mauritz 77 (LE); Chitinsky Uezd, Ungur Valley, 1 July 1912, B. Zamoshnikov s.n. (LE); Pokrovka Village, 9 July 1872, Augustinowicz s.n. (LE); Nerchinsk, slopes, in bushes of stony places, June 1890, Stukov 542 (LE); Nerchinsk, Sedakov s.n. (LE); Nerchinsk, near Bayankin, 15 June 1909, V. Sukachev s.n. (LE); Nerchinsk, Vladimerov s.n. (LE); near Nerchinsk, in shrubs on slopes, June–July 1899, Mauritz s.n. (LE); near Nerchinsk, 20 June 1910, V. I. Znamenskaya s.n. (LE); Nerchinsk, S slopes, left radical bank of Shilka River, 2 June 1913, Kazansky 8 (LE); Nerchinsk, Kalga Village, 1 Sep. 1904, G. A. Stukov, s.n. (LE); Nerchinsk, Kalga Valley, 23 June 1953, E. S. Romanova & L. N. Lukjanova s.n. (LE); Nerchinsk, Sanparoff 1849 (LE); *loc. eodem*, Chesnokoff s.n. (LE); *loc. eodem*, Stschukin (Shchukin) s.n. (LE); *loc. eodem*, June 1834, S. Shchukin s.n. (LE); *loc. eodem*, stony slopes, June 1890, G. A. Stukow 542 (LE); *loc. eodem*, 1844–1849, Sensinoff 335 (LE), 235 (LE), 250 (LE), 435 (LE) and 516 (LE); *loc. eodem*, Sosnin, s.n. (LE); June 1834, S. Shchukin, Reliqu. Ledebour s.n. (LE); ‘Kirpichnaya’, slopes in bushes, June–July 1899, T. Mauritz s.n. (LE); watershed of Shilka and Chernaya Rivers, near mouth of Chernaya River, 8 June 1909, N. Kuznetsov 157 (LE); ‘Kirpichnaya’, on slopes, common, 9 June 1912, I. P. Kychakov s.n. (LE). Between Shilka and Argun, 1831, Turczaninov s.n. (LE). Nizhnije Klyuchi in Shilka Valley, S slopes, 18 June 1911, V. Sukachev & G. I. Poplavskaya 3199/825 (LE). **OLINSKY DISTR.:** Koltomonon, meadows in forests, 31 July 1927, E. Solonova & L. Shmeleva s.n. (LE); 25 km NW of Priargunsk, *s. coll.* 368.5/713-2 (LE); near Ust’-kir-kira, in ravines, 25 July 1930, Shverskaya s.n. (LE); between Ingodam and Shilka, meadows, 1831, Turczaninov s.n. (K, LE). Near Sretensk, S steppe

slopes, 21 Aug. 1910, *V. Sukachev* & *G. I. Poplavskeya* 1377 (LE) and 2220 (LE). **IMANSKY DISTR.:** Iman Valley, 9 km from Karzhun Village, 8 June 1913, *Z. Bujanova* 6 (LE) and 8 (LE); Iman Station, 12 Aug. 1912, *E. M. Terentjeva* s.n. (LE). Jodzikh Valley, in forests, 7 July 1907, *N. Desoulavy* 1155 (LE). Kamen'-Rybolov, in bushes in black sandy soil, 1 June 1875, *Palczewski* s.n. (LE); Ussuri Valley, above Kinda Village, 5 Aug. 1855, *Maximowicz* s.n. (LE); Ussuri Region, Grishchevka Village, Kame'-Rybolov, 1 June 1885, *Palchevsky* s.n. (LE). Luchikheza Valley, near Sarvakvan Village, *Corylus* thickets, W slopes, 23 June 1930, *M. A. Zhukova* 163 (LE). **KHABAROVSKY PROV.,** Alexandro-Mikhajlovka Village, right bank of Ussuri, 15 June 1909, *Varpakhovsky* s.n. (LE); Khabarovsk, meadows in forests, 23 June 1902, *N. Desoulavy* 105 (LE); near Khabarovsk, Nadezhdinskaya, Bira Valley, dry places, 6 Aug. 1913, *O. Kuzeneva* 62 (LE). **KHASANSKY DISTR.:** Vinogradarsky sovkhos, 7 June 1950, *V. N. Vasiljev*, *E. V. Volkova* & *L. I. Ivanina* s.n. (LE); Gladkaya Valley, steep slopes, 6 June 1951, *V. N. Vasiljev*, *E. V. Volkova* & *L. I. Ivanina* s.n. (LE); slopes, among bushes, 12 June 1928, *D. Vorobjov* 155 (LE); Vladimiro-Monomakhovskoje Village, on slopes, 30 May 1909, *N. V. Dyukina* s.n. (LE); **MIKHAILOVSKY DISTR.:** 4 km SW of Lipovtzy, NW slope, 13 June 1929, *I. Kuznetsov* 101 (LE); left side of Repjovka River, N slopes, 19 June 1929, *I. Kuznetsov* 129 (LE); SE of Dubki, E slopes, thickets, 8 June 1929, *I. Kuznetsov* 44 (LE); Cape of Olimpiada, 7 July 1915, *N. P. Krylov* 28 (LE); 4 km from Galenka, right side of Krestyanka River, steep slopes, in bushes, 13 June 1929, *M. A. Zhukova* 107 (LE); 10 km NNW of Mikhajlovka, left side of Repjovka River, SW grassy slopes, 19 June 1929, *M. A. Zhukova* 132 (LE); near Dubki Village, S steep slopes, in bushes, 20 June 1929, *V. P. Bayanova* 150 (LE). Monguchai Valley: near Ovchinnikovo Village, 12 June 1913, *N. Dyukina* s.n. (LE); Southern-Ussuri Region, Ryndin 50 (LE); Shirokaya, 12 June 1913, *N. V. Dyukina* 470 (LE). Nikolayevsk-Ussurijsk, 30 Aug. 1905, *P. V. Siuzev* s.n. (LE). Nikolsk-Ussurijsk: in coniferous forests, 10 Aug. 1913, *A. I. Frantz* s.n. (LE); Southern-Ussuri Flora Reserve Plot, 6 June 1916, *s.coll.*, s.n. (LE); near Nikolsk, Mt Lokmataya, 20 June 1915, *T. P. Gordeev* s.n. (LE); 15 km from Nikolsk and Maly Suifun, 10 June 1872, *Goldenstadt* 12 (LE). **NEKRASOVSKY DISTR.:** Khora Valley, *Quercus* forests in alluvium soil, 19 Aug. 1927, *O. Neimar* 198 (LE); left bank of Kia River, in forests, 22 Aug. 1927, *O. Mamorina-Kiseleva* s.n. (LE); Podkhorenka Valley, *Quercus-Abies* forests, 10 Aug. 1926, *V. Siralev* 151 (LE); Troitzkoje Village on Amur, clearings in forests, 16 June 1908, *N. Desoulavy* 1371 (LE). **OLGINSKI DISTR.:** Petrovskaya Volost, Kengouz Bay, common, 12 June 1912, *M. Kosovanova*, s.n. (LE); Olga Bay, 15–20 June 1863, *Albrecht* s.n. (LE); Olga Bay, June 1861, *F. Schmidt* s.n. (LE). **POKROVSKY DISTR.:** 5 km NW of Vladimirovka, in bushes, 19 June 1930, *N. O. Mamontova* 14 (LE); Vladimirovka Village, meadows, among bushes, May 1920, *T. I. Solokhin* 926 (LE); 3 km S of Pokrovka Village, in sparse bushes, 11 June 1930, *M. A. Zhukova* 18 (LE). **POSSJET DISTR.:** Adimi Valley, on S slopes, 23 June 1929, *A. Saverkin* 272 (LE); Maly and Bolshoj Mangugaj Pass, NW slopes, 3 July 1929, *A. Saverkin* 319 (LE); valley forests in upper reaches of Chapigou River, 5 June 1928, *A. Saverkin* 308 (LE). **PRIMORSKY PROV.,** America Bay, Nakhodka, bushes in clearings of *Quercus* forests, *A. I. Bulavkina* s.n. (LE); America Bay, near Nakhodka, on slopes, in bushes, 1 July 1913, *A. I. Bulavkina* 356 (LE); Anuchinsky, near Saratovka Village, 23 June 1976, *N. Prisyazhnyuk* s.n. (LE). Barabash, on slopes, open places, *C. Gavronski* s.n. (LE). Yuzhno-Ussurijsky, Barabash Village, 20 June 1900, *N. Shestunov* 706 a (LE). **SHKOTOVSKY DISTR.:** Maikhe Valley, near Mnogodobny Village, 20 June 1927, *M. Ivanova* s.n. (LE); Maikhe Valley, Novo-Khotunchi Village, oak forests, 13 June 1913, *V. L. Komarov* 211 (LE). **SHMAKOVSKY DISTR.:** near Arkhangelovka Village, meadows, 29 June 1927, *M. Polevoi* 7 (LE); Pchelinoje Village, dry meadows by Kabarga River, 12 June 1928, *G. Karev* 61 (LE); Pavlo-Fedorovka Village, bushes on slopes, 27 June 1928, *L. Nekrasova* 481 (LE); *loc. eodem*, 22 June 1928, *L. Nekrasova* s.n. (LE); near Komarovka Village, E slopes, in bushes, 23 June 1928, *I. V. Zhiron* 89 (LE). **SPASSKI DISTR.:** Krasilovka Village, clearings of *Quercus* forests, NW slopes, 8 June 1929, *L. Nekrasova* 1047 (LE); Khanka Lake, mouth of Lefu River, 30 May 1869, *Przewalski* s.n. (LE); Khanka Lake, near

Troitzkoje Village, among bushes, 13 June 1909, *A. Chersky & M. Cherskaya* s.n. (LE). **SUCHAN BASIN:** Aug. 1882, *V. Fedorovsky* 1 (LE); near Gir'yashino Village, in bushes on slopes, 15 Aug. 1913, *A. Bulavkina* 1408 (LE); Lamaza Valley, mixed forests, 16 June 1950, *V. N. Vasiljev, E. V. Volkova & L. I. Ivanina* s.n. (LE). **SUIFUN BASIN:** Elduga Valley, 40 km from Razdol'noje Village, in woods, 26 June 1951, *V. N. Vasiljev, E. V. Volkova & T. N. Gordeeva* s.n. (LE); Sinelnikovskije summits by Suifun River, 26 May 1896, *V. L. Komarov* s.n. (LE); Mt Sancha-gou by Suifun River, opposite Chinese town Sanchagou, 13 June 1896, *V. L. Komarov* s.n. (LE); Allintuj Valley, between Puchikino and Kijevka, forests, 4 June 1913, *N. V. Schipczinsky* 92 (LE). Suputinka Basin, Acad. Sci. USSR Gorno-Tajozhnaya Station, Krivoj Klyuch Valley, SE slopes with exposed granites, 18 June 1951, *V. N. Vasiljev, E. V. Volkova & T. N. Gordeeva* s.n. (LE); Terney Bay, 11 Aug. 1906, *N. A. Palczewski* s.n. (LE); Tyutikhe Valley, N of St. Vladimir Bay, near Vladimir-Monomakh, on slopes, 9 June 1909, *N. Dyukina* s.n. (LE); Vladivostok, St. Vladimir, Northern Bay, E slopes, 31 Aug. 1931, *A. Zinova* 22 (LE). **SUIFUNSKY DISTR.:** near Nikolsk-Ussurijsk, Mt Lokhmataya, 22 June 1927, *V. Transhel* 495 (LE); near Nikolsk-Ussurijsk, Izvestkovy Ridge, 15 June 1927, *V. Transhel* 371 (LE) and 373 (LE); Nikolsy-Ussurijsk, Vladivostok, 5 June 1920, *K. Mandl* s.n. (WU); *loc. eodem*, 10 June 1920, *K. Mandl* s.n. (WU). **VOROSHILOVSKY DISTR.,** on road from Nikolo-L'vovskiy to Sarbaklan, roadsides, 15 July 1952, *V. N. Vasiljev & M. V. Gorelkina* s.n. (LE).

12. *Paeonia emodi* Wall. ex Royle, *Ill. bot. Himal. Mts*, 57 (1834); Wallich, *Cat. No.* 4727 (1831), nom. nud.; J. D. Hooker, *Bot. Mag.* 94: tab. 5719 (1868); J. D. Hooker & Thomson in Hook. f., *Fl. Brit. India* 1: 30 (1875); Lynch, *J. Roy. Hort. Soc.* 12: 437 (1890); Stern, *J. Roy. Hort. Soc.* 68: 129 (1943); Lynch, *Study Gen. Paeonia*, 94 (1946); Riedl in Rechinger, *Fl. Iranica* 60: 5 (1969); Rau, *Fascicles Fl. India* 1: 5–8, figs. 1–3 (1978); Polumi & Stainton, *Fl. Himalaya*, 18, pl. 9 (1984). *Paeonia anomala* L. var. *emodi* (Wall. ex Royle) Huth, *Bot. Jahrb. Syst.* 14(3): 269 (1891). TYPE: India, Kumaon, May 1824, Wallich no. 4727 (holotype K!; isotypes BM!, E!, G!, P!).

Paeonia emodi Wall. ex Royle var. *glabrata* Hook. f. & Thomson in J. D. Hooker, *Fl. Brit. India* 1: 30 (1875). *Paeonia emodi* Wall. ex Royle f. *glabrata* (Hook. f. & Thomson) H. Hara in H. Hara & Williams, *Enum. Fl. Pl. Nepal*. 2: 23 (1979). TYPE: not designated.

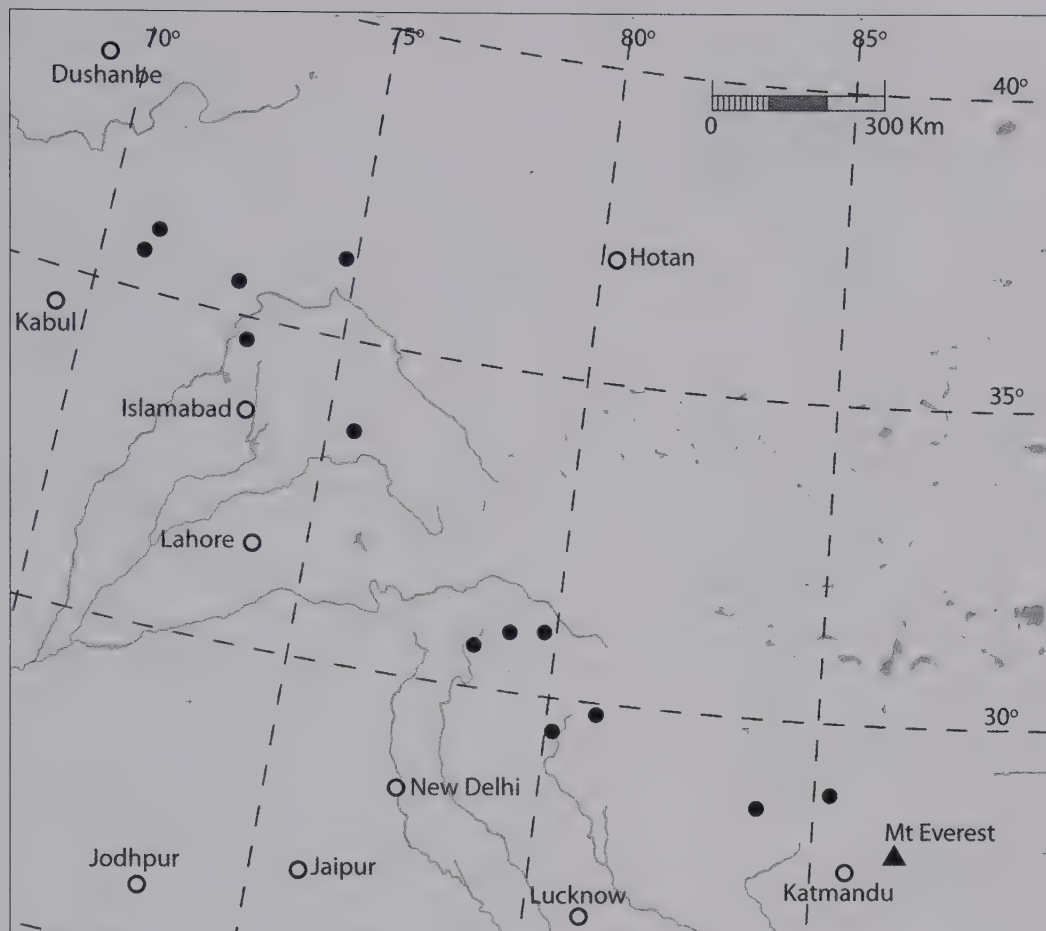
Paeonia officinalis auct. non L.: J. D. Hooker & Thomson, *Fl. Indica* 1: 60 (1855).

Perennials. Roots carrot-shaped, up to 2.5 cm in diameter. Caudex short, not elongated. Scales at the base of stems 5–8 in number, purple-red. Stems up to 60 cm tall, green. Lower leaves biternate, with some or all of 9 leaflets segmented; leaflets/leaf segments 15–27 in number, ovate-lanceolate to lanceolate, 7–14 cm long, 1.5–3.8 cm broad, glabrous or with sparse bristles along veins above, always glabrous beneath, some segments lobed, lobes acuminate at the apex. Flowers mostly 2–3, terminal and axillary at axils of the upper leaves, rarely solitary and terminal; involucre bracts 3–4 in number, leaf-like; sepals 3–4 in number, green, ovate-orbicular to orbicular, all caudate at the apex, 1.2–2.0 cm long (tailed part excluded), 1–2 cm broad; petals white, 8–10 in number, obovate, often bilobate, c. 4 cm long, c. 3 cm broad; filaments yellow; anthers yellow; disk pale pink, waved; carpels single, occasionally 2, green, tomentose with hairs 1–2 mm long, less frequently glabrous; styles absent or up to 1 mm long; stigmas pink, 1 mm wide. Follicles long-ovoid or ellipsoid, 2–3.5 cm long, 1.2–1.5 cm in diameter. Seeds brown-black, oblong, 7–9 mm long, 3.5–6 mm in diameter. Figs 5.12A, 5.12B.

PHENOLOGY. Flowering in May and early June; fruiting from July to August.

CHROMOSOME NUMBER. Diploid with $2n = 10$ (Dark, 1936; Stern, 1944; Zhang & Sang, 1999), and tetraploid with $2n = 20$ (a new report for the literature in the present work vouchered from Xizang (Tibet), *S. L. Zhou* H01031).

HABITAT AND DISTRIBUTION. Growing in bushes on dry or rocky slopes at altitudes from 1600 to 3,200 m. The western Himalayas and northeastern part of the Hindu Kush: China (SW Xizang (Tibet) and S Xinjiang), NW India, W Nepal, N Pakistan and E Afghanistan (Nuristan, Chetras) (Riedl, 1969). Map 5.12.



Map 5.12. Distribution of *Paeonia emodi* Wall. ex Royle.

NOTES. Hooker & Thomson (1875) described a form of *Paeonia emodi* with glabrous carpels as the variety *glabrata*. All six flower specimens that I examined in the Herbarium of Royal Botanic Garden Edinburgh (E) have tomentose carpels and follicles. However, in other collections at the Conservatoire et Jardin botaniques de la Ville de Genève (G), the carpels and follicles of seven flowers (from five specimens Aswal 11983, Naithani 48250, Naithani 47920, Lamond 1828 and Wallich 4727) are tomentose; whereas those of four flowers (from Naithani 47920 and I. S. G. S. sin.) are glabrous. Falconer 77 from Kashmir (P) has two individuals (stems) that are alike; their carpels are both single, but one is glabrous whereas the other is tomentose. According to Miss J. Coote's field observation in Kashmir, the form with tomentose carpels and that with glabrous carpels "grew together and they were exactly alike in height, appearance and mode of growth" (Stern, 1946: 96). It seems to us that pubescent or glabrous carpels reflect another example of polymorphism in carpel character for *Paeonia emodi*.

Paeonia emodi most resembles *P. anomala*, *P. sterniana* and *P. lactiflora*, but it differs from all of these species in having the carpels mostly single (92.6%), rarely two (7.4%). In addition, it is different from *P. lactiflora* in having leaf margin smooth (rather than cartilaginous thickened and dentate-spinose) and the carpels mostly tomentose (88%; rather than usually glabrous). *Paeonia emodi* differs from *P. anomala* in having the leaflets/leaf segments no more than 30 in number (as opposed to 70 to 100), and from



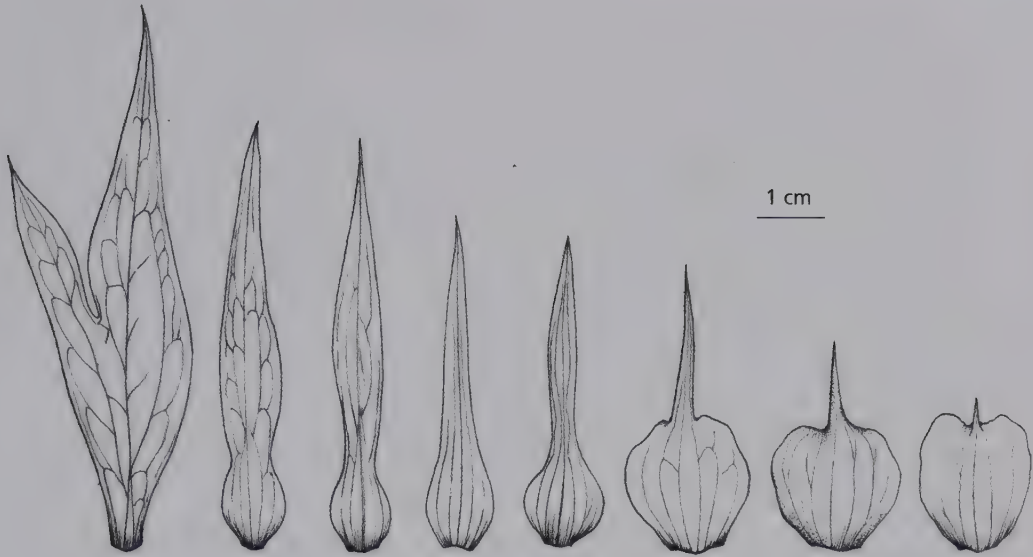


Fig. 5.12B. *Paeonia emodi* Wall. ex Royle: involucrate bracts and sepals, based on S. L. Zhou H01031 (PE). Drawn by Miss LI Ai-Li.

P. sterniana in having nearly always multiple flowers per stem (rather than nearly always solitary) and the carpels mostly tomentose (rather than always glabrous).

Saunders and Stebbins (1938) crossed *Paeonia anomala* and *P. emodi*, obtaining a very low seed set and sterile hybrids. This supported their observation that the two species are not only morphologically distinct but also reproductively isolated.

ADDITIONAL SPECIMENS EXAMINED. **CHINA, Xizang [Tibet], Gyirong County:** Jiangcun Village, W slope, 28°18'N, 85°20'E, 2,480 m, in shrubs, 2 Aug. 2001, S. L. Zhou H01031 (A, BM, CAS, K, MO, P, PE); *loc. eodem*, in bushes, 2,500 m, 20 June 1975, *Acad. Sin. Nat. Resources Exped.* 75–247 (PE); *loc. eodem*, E slope, 2,350 m, 6 June 1972, *Xizang Chinese Traditional Medicinal Plant Exped.* 413 (PE). **XINJIANG,** Kashkaria, Brumhal Pass, May 1870, *Henderson, Yarkand Exped.* 1870 (LE). **INDIA, Uttarakhand:** Kumaon, Pithoragarh Bogdiar, 3,000 m, 29 Apr. 1965, N. C. Nair 35613 (CAL); *loc. eodem*, 2,000 m, 2 May 1966, N. C. Nair 36295 (CAL); *loc. eodem*, 3 May 1965, N. C. Nair 35634 (CAL); Kumaon, Dwali, 2,438 m, 16 May 1848, R. Strachey & J. E. Winterbottom s.n. (CAL); *loc. eodem*, Naga Hills, 2,438 m, 18 June 1882, H. Collett 7 (CAL); Kumaon, Khati, 2,740 m, 10 June 1919, N. Gill 829 (CAL); Kumaon, China Pahar, 2,286 m, May 1912, N. Gill 452 (CAL); Kumaon, China Peak, 2,286 m, 19 June 1913, N. Gill 531 (CAL); Kumaon, Pondur, 2,286 m, 16 May 1848, R. Strachey & J. E. Winterbottom s.n. (CAL); Kumaon, Rathi-Bogdwar, 2,000–3,000 m, 13 May 1958, T. A. Rao 6755 (CAL); Kumaon, 2,300 m, 1843, *Strachey & Winterbottom* 1 (P); Kumaon, W Almora, Pindari River, *Biskam* 2330 (E); Baba Pum, Reeckee, 9 June 1847, *Winterbottom* 180 (P); Garhwal Himalayas, Gangani, Uttarkashi, 1,800 m, 3 June 1982, B. S. Aswal 11983 (F, G); Garhwal, Sitapur, 1,600 m, 21 May 1972, B. D. Naithani 47920 (CAL, G); Garhwal, Ramssi forest, 2,500 m, 10 June 1959, M. A. Rau 10099 (CAL); Garhwal, Kanara to Mohankhal, 2,100 m, 27 Apr. 1963, C. L. Malhotra 27233 (CAL); Tehri-Garhwal, 2,100 m, May 1893, I. S. G. s.n. (G); Tehri-Garhwal, Ghuttu–Area, 1,800 m, 10 June 1972, B. D. Naithani 48250 (CAL, G); Tehri-Garhwal, Shanchatti,

Fig. 5.12A (opposite). *Paeonia emodi* Wall. ex Royle: **a**, the lower part of the plant; **b**, stem with a lower leaf; **c**, carpels and disk; **d**, the upper surface of a leaf, showing bristles along veins. Drawn by Miss LI Ai-Li.

12. *PAEONIA EMODII*

on way to Jumnotri, 2,000 m, 12 June 1961, *M. A. Rau* 15655 (CAL); Tehri-Garhwal, Hanumanganga Valley, 2,000 m, 27 Apr. 1968, *C. M. Arora* 37852 (CAL). **Kashmir:** *s. loc.*, *Falconer* 77 (P); *s. loc.*, *V. Jacquemont* 668 (P) and 750 (P); *s. loc.*, June 1956, *T. A. Rao* 748 (CAL); Banahal Pass, 2,600 m, May 1929, *Steane* 6 (E); Jamunatri, 1,970 m, 21 June 1953, *S. N. Mitra* 9516 (CAL); Ashmakam-Pahalgam, 1,830–2,400 m, June 1905, *A. Meebold* 3350 (CAL); Chandanwari, 3,000 m, 25 June 1959, *T. A. Rao* 9690 (CAL); NW India, *J. L. Stewart* 1871 (E). **NEPAL**, near Gurta, 2,300 m, 25 June 1966, *T. B. Shrestha* 5238 (KATN, US); Khati Chamila River, 1,800 m, dry slopes, 23 June 1965, *T. B. Shrestha* 4247 (KATN); Makarigod-Khaudeshori (Darchula Distr.), 2,090 m, in semi-shady places, locally abundant, 18 July 1984, *R. R. Sharya, M. R. Adlikari & M. N. Subedp* 7904 (KATN). **PAKISTAN**, in north-west, Swat, Mt E. Kalam, 35°26'N, 72°39'E, in *Indigofera* scrubs, 3,000 m, 6 June 1965, *J. Lamond* 1828 (E, G, W); Swat State, between Maina and Mt Ilam, 2,440 m, 12 Aug. 1952, *R. J. Rodin* 5451 (US); Haran, Hazara, 2,400–2,750 m, 2 July 1957, *Altad Shah* 29091 (E); Hazara, Kaghan Valley, 2.5 km N of Naran, 2,400 m, dry rocky hillsides, W slope, 24 June 1958, *B. L. Burti & M. Arshad Ali* B854 (E); Hazara, Kalapani-Thandiani Road, c. 1,830 m, 14 June 1975, *M. N. Chaudhri & al.* 34 (W); Hazara, Dara Kullu, Saran Valley, 3,170 m, 11 June 1899, *Inayat s.n.* (CAL); Hazara, Khor, Saran Range, 3,200 m, 8 June 1899, *Inayat s.n.* (CAL); Chitral, Ziarat, 2,290 m, 20 May 1895, *Sarg. Lt. Harris* 15814 (CAL, WU); *loc. eodem*, 2,290 m, 14 June 1895, *Sarg. Lt. Harris* 15812 (CAL); Gugor, 2,130–2,740 m, 18 May 1895, *Sarg. Lt. Harris* 15813 (CAL); Lunbugla, 24 May 1962, *R. R. Stewart & E. Nasir* 387 (US); Mirga, 2,340 m, 2 Sep. 1895, *B.-G. Gatacre* 17017 (CAL); Morga, 2,440 m, 2 Sep. 1895, *Sarg. Lt. Harris* 17017 (WU); near Taulipir, 2,140 m, 22 Apr. 1953, *A. Rashid, E. Nasir & R. R. Stewart* 25551 (W).

13. *Paeonia sterniana* H. R. Fletcher, *J. Roy. Hort. Soc.* 84: 327, fig. 103 (1959); Pan, *Fl. Reip. Pop. Sin.* 27: 54, pl. 8, figs 2–3 (1979); Hong, *Novon* 7(2): 160 (1997); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 132 (2001). *Paeonia emodi* Wall. ex Royle subsp. *sterniana* (H. R. Fletcher) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(1): 30 (1997) and in *Gen. Paeonia*, 119 (2004). TYPE: CHINA, SE Xizang [Tibet]: Kongbo, Tsangbo Valley, between Tripe and Gyala, 2,830 m, 24 Apr. 1947, *F. Ludlow, G. Sherriff & H. H. Elliot* 13543 (holotype BM!). CHINA, Xizang [Tibet]: Tsangpo Valley, Gyala, 29°43'N, 94°56'E, 2,830 m, 21 July 1938, *F. Ludlow, G. Sherriff & G. Taylor* 5350 (paratype BM!), 26 Sep. 1938, *F. Ludlow, G. Sherriff & G. Taylor* 5350a (paratype BM!); Tamnyen, c. 29°30'N, 94°40'E, 2,900 m, 5 Aug. 1947, *F. Ludlow, G. Sherriff & H. H. Elliot* 14231 (paratype BM!).

Perennials, 35–60 cm tall, glabrous throughout. Roots carrot-shaped, tap roots up to 2 cm in diameter, more than 30 cm long. Caudex short, not elongated, multi-branched, and thus many stems caespitose. Scales at the base of stems 6–9 in number, pink. Lower leaves biternate; leaflets 9, the terminal three often more-or-less decurrent; all leaflets segmented; leaflets/leaf segments 20–30 in number, 4–12 cm long, 1.5–3 cm wide, often lobed; lobes acuminate at the apex. Flowers solitary, terminal, but one or two axillary undeveloped (sterile) buds often present, rarely 2 on a stem; involucre bracts 2–4 in number, leaf-like; sepals mostly 3, rarely 4 in number, nearly rounded, all or mostly caudate at the apex, green or purple, 1–2.3 cm long, 0.8–2 cm wide; petals white to pale rose, obovate, 2.5–3 cm long, 1.5–2 cm wide; filaments yellow; anthers yellow; disk less than 1 mm high, waved, green-yellow; carpels mostly 2, less frequently 3, rarely 4 in number, green; styles less than 1 mm long, stigmas red, 1.2 mm wide. Follicles ovoid, c. 3 cm long. Seeds ovoid-oblong, black, lucid, 7–8 mm long, 5 mm in diameter. Figs 5.13A, 5.13B.

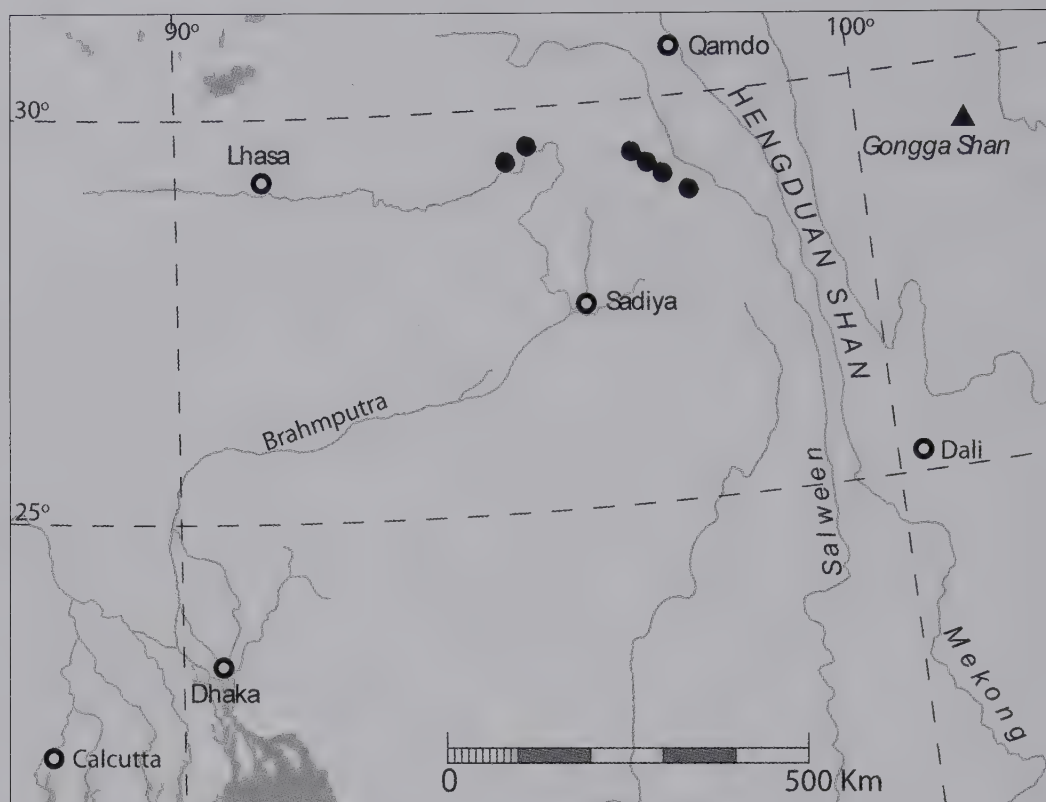
PHENOLOGY. Flowers from mid May to early June; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (the present work with the voucher: Tibet, A. S. Xu H03021 (PE)).

HABITAT AND DISTRIBUTION. Growing in forests or thickets at a high altitude of 2,830–3,500 m. Confined to SE Xizang (Tibet), China. Map 5.13.



Fig. 5.13A. *Paeonia sterniana* H. R. Fletcher: **a**, the lower part of the plant, showing carrot-shaped roots, caudex and scales at the base of the stem; **b**, the upper part of the plant and a flower with petals and stamens shed, showing disk and carpels; **c**, a lower leaf. Drawn by Miss LI Ai-Li.



Map 5.13. Distribution of *Paeonia sterniana* F. R. Fletcher.

NOTES. *Paeonia sterniana* is closely related to *P. emodi*. They share a number of characters: the roots carrot-shaped; sepals all or mostly caudate at the apex; leaflets mostly or all segmented; petals white; and plants entirely glabrous except for the carpels, which are mostly pubescent in *P. emodi* but glabrous in *P. sterniana*. Nevertheless, these two species distinctly differ from each other. *Paeonia emodi* often has two or three flowers on a stem, whereas *P. sterniana* nearly always has a single flower (occasionally two) and sometimes one or two axillary sterile buds on a stem. The carpels are single (93%), rarely two (7%) per flower, and nearly always tomentose in *P. emodi*, whereas there are two to four, always glabrous carpels in *P. sterniana*. Therefore, Halda's (2004) treatment of *P. sterniana* as a subspecies in *P. emodi* cannot be justified.



Fig. 5.13B. *Paeonia sterniana* H. R. Fletcher: involucre bracts and sepals, based on A. S. Xu H03021 (PE). Drawn by Mr SUN Yin-Bao.

ADDITIONAL SPECIMENS EXAMINED. CHINA, **Xizang [Tibet], Bomi:** Sumzum Township, S of Parlung Zangbo, near Deba Village, 3,100 m, Sep. 2003, A. S. Xu H03021 (PE); *loc. eodem*, 3,150 m, in *Quercus aquifolioides* forests, 27 May 1996, D. Y. Hong, Y. B. Luo & S. R. Zhang H96029 (A, K, MO, PE, US); *loc. eodem*, 19 May 2006, D. Y. Hong, Z. Q. Zhou & A. S. Xu H06017 (PE); Sumzum Township, Mimi, 3,500 m, 4 Sep. 1965, J. S. Ying & D. Y. Hong 1097 (PE); Yipuzang, 3,300 m, Fei, Sun, Li & Bai 244 (KUN); between Bomi and Ranwu, 3,500 m, 22 June 1980, Ni, Wang, Ciduo & Cidan 0133 (PE, XZ); between Bomi and Ranwu, 3,500 m, Naito, Lang, Tateishi, Nemoto & Li 763 (PE); 85 km from Ranwu to Bomi, Fei, Sun, Li & Bai 145 (PE); Sumzum to Aguo, 3,000 m, Xizang Suppl. Exped. Wu 5930 (KUN). **Zayü,** between Giyu and Cinong, 3,300 m, 21 June 1973, Qinghai-Xizang Exped. 73-294 (PE).

14. *Paeonia anomala* L., Mant. pl. 2: 247 (1771); Retzius, *Observ. bot.* 3: 36 (1783); Sims, *Bot. Mag.* 42: tab. 1754 (1815); Anderson, *Trans. Linn. Soc. London* 12: 261 (1818); de Candolle., *Syst. nat.* 1: 393 (1818); de Candolle, *Prodr.* 1: 66 (1824); Meyer et al., *Fl. altaic.* 2: 277 (1830); Trautvetter, *Enum. pl. songor.* (Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 33:) 87 (1860), pro parte, excl. var. *hybrida* and var. *hybrida* f. *intermedia*; Baker, *Gard. Chron.* n. ser. 21: 828 (1884), pro parte, excl. syn.; Lynch, *J. Roy. Hort. Soc.* 12: 434 (1890); Huth, *Bot. Jahrb. Syst.* 14: 268 (1891), pro parte, excl. var. *hybrida* and var. *emodi*; Krylov, *Fl. Altaya* 1: 46 (1901); Schipczinsky, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 46 (1921); Schipczinsky in Komarov, *Fl. USSR* 7: 33 (1937); Stebbins, *Univ. Calif. Publ. Bot.* 19: 252 (1939); Stern, *Study Gen. Paeonia*, 112 (1946), pro parte, excl. var. *intermedia*; Cullen & Heywood in Tutin et al., *Fl. Europ.* 1: 243 (1964), pro parte, excl. var. *intermedia*; Pan, *Fl. Reip. Pop. Sin.* 27: 59 (1979), pro parte, excl. var. *intermedia*; Akeroyd in Tutin et al., *Fl. Europ. edn 2*, 1: 293 (1993), pro parte, excl. var. *intermedia*; Krupkina in Tzvelev, *Fl. Europ. Orient.* 9: 173 (1996), pro parte, excl. *P. intermedia* and var. *intermedia*; Schmitt, *Pl. Mont.* 191: 574 (1999), pro parte, excl. subsp. *pamiroalaica*, syn. *P. hybrida* and *P. intermedia*; Halda, *Gen. Paeonia*, 96, 102 (2004), pro parte, excl. subsp. *hybrida* and syn. *P. intermedia*; Hong, *Fl. China* 6: 132 (2001); Hong & Pan, *Ann. Missouri Bot. Gard.* 91: 90 (2004). TYPE: LINN n° 692.3 (lectotype designated by Schmitt 2003: 187, LINN!).

Paeonia laciniata Pall., *Fl. ross.* 1(2): 93, tab. 85, sub *P. sibirica* (1788). TYPE: tab. 85 in Pall., 1788 (holotype!).

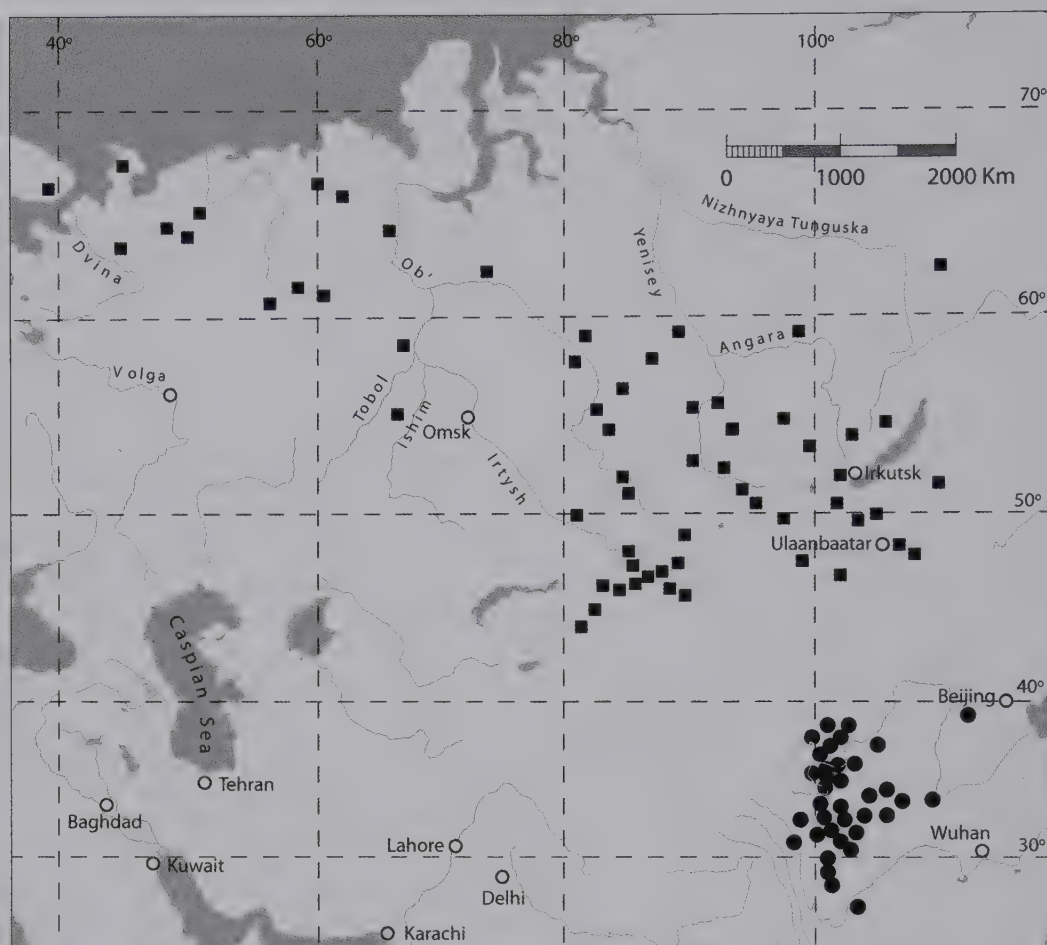
Paeonia sibirica Pall., *Fl. ross.* 1(2) 2: tab. 85 (1788), nom. nud.

Perennials. Tap roots up to 1 m long, thickened, carrot-shaped, attenuate downwards, up to 2 cm in diameter, lateral roots also carrot-shaped, neither tuberous nor fusiform. Lower leaves biternate; leaflets often decurrent, finely segmented; lower leaves with leaflets 9 and segments 70–100 in number; segments 2–13 cm long, 0.8–3.2 cm wide, with bristles along veins above, glabrous beneath. Flowers solitary or 2–4 on a stem, often only the terminal one fully developed and blooming; involucre bracts 1–3 in number, leaf-like; sepals 3–5 in number, mostly caudate at the apex, rarely 1 or very occasionally 2 non-caudate, hispidulous only near the top on the adaxial surface, glabrous, very rarely hispidulous on the abaxial surface; petals rose, pale red or red, but rarely white in subsp. *veitchii*, 6–9 in number, obovate, entire or incised at the apex, 4–5.5 cm long, 3–4 cm wide; disk waved, c. 1.5 mm high; carpels mostly 3 to 5 in number, densely tomentose, rarely sparsely hairy or glabrous; ovules 12–16 in number per carpel; styles absent or less than 0.5 mm long; stigmas red, 2 mm wide. Follicles columnar, 1.5–2.8 cm long, 1–1.2 cm wide. Seeds ovoid or ovoid-spherical, black, 6–7 mm long, 4.5–5 mm wide. Figs 5.14A, 5.14B.

PHENOLOGY. Flowering in different periods at different localities, from late April to middle July; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (see the subspecies for detail).

HABITAT AND DISTRIBUTION. Preferring relatively moist habitats, growing in forests, on the edges of forests, or rarely in bushes or meadows. It is found from lowlands to an altitude of 3,870 m. A few



Map 5.14. Distribution of *Paeonia anomala* L.: squares = subsp. *anomala*; black circles = subsp. *veitchii* (Lynch)
D. Y. Hong & K. Y. Pan.

collections recorded limestones, granites and sandstones as the media in which this species grows. Widely distributed from China to the Kola Peninsula of Russia via Siberia and Central Asia (Map 5.14).

NOTES. Pallas's (1788) illustration tab. 85 has only one name, *Paeonia sibirica*, and apparently he used this illustration also for *P. laciniata*, because one sees "*Paeonia laciniata* Tab. LXXXV" on p. 93. *Paeonia laciniata* was described in detail by Pallas, but no description was given for *P. sibirica* by him.

Paeonia anomala had been confused with *P. intermedia* and *P. hybrida* long before the work of Hong and Pan (2004), who reviewed the taxonomy of this complex and discussed its relationships in detail on the basis of field observations and examination of the types of these three taxa and a large quantity of specimens. Since the work of Sims (1815), all authors described the root of *P. anomala* as tuberous (or fusiform), e.g. Anderson (1818), Schipczinsky (1937), Gamaulova (1961), or gave no description of its roots, e.g. de Candolle (1818), Lynch (1890) and Stern (1946). Actually, *P. hybrida* is a synonym of *P. tenuifolia*, as in Anderson's treatment (1818). According to our observations in the Altai, the populations that had the majority of sepals caudate at the apex always had carrot-shaped roots, whereas those with more sepals rounded (non-caudate) at the apex always had tuberous roots. The examination of specimens from Siberia and Mongolia shows that they consistently had the majority of sepals caudate at the apex and carrot-shaped roots. The type of *P. anomala* L. is from Siberia, and the two sepals visible on the sheet are both caudate at the apex. Most specimens

examined from western and southern parts of the Altai westward to Uzbekistan had tuberous roots, if roots were collected, and most sepals were non-caudate. The type of *P. intermedia* C. A. Mey., which was collected from the Altai (Ledebour s.n., holotype K!; isotype LE!), has tuberous roots. It is clear that *P. anomala* has carrot-shaped roots, which are correlated with caudate sepals, whereas *P. intermedia* has tuberous roots, which are correlated with non-caudate sepals.

Saunders and Stebbins (1938) made crosses between *P. anomala* and *P. veitchii*, *P. anomala* and *P. beresowskii*, *P. anomala* and *P. woodwardii*, *P. veitchii* and *P. beresowskii*, *P. veitchii* and *P. woodwardii*, and *P. beresowskii* and *P. woodwardii*. All of these species pairs were easily crossed and the hybrids were fertile, similar to crosses between individuals of the same subspecies. This is consistent with the conclusion we reached on the basis of external morphology: these four taxa fall within the same species.

Paeonia anomala has two allopatric subspecies, with the typical subspecies distributed northwest of the Gobi, whereas the subspecies *veitchii* is in China southeast of the Gobi (Map 5.14).

Key to subspecies of *Paeonia anomala*

- 1a. Flowers solitary, rarely 2, or solitary but with one additional undeveloped axillary bud on a stem (Central Asia to the Kola Peninsula via Siberia) 14a. subsp. *anomala*
- 1b. Flowers 2–4, rarely solitary but with 1–2 additional undeveloped axillary buds on a stem, very occasionally solitary (central China) 14b. subsp. *veitchii*

14a. *Paeonia anomala* subsp. *anomala* Hong & Pan, *Ann. Missouri Bot. Gard.* 91(1): 90 (2004).

Paeonia sinjiangensis K. Y. Pan, *Fl. Reip. Pop. Sin.* 27: 603, fig. 12 (1979); Hong, Pan & Li, *Acta Phytotax. Sin.* 32(4): 351, figs 2, 6–10 (1994); Schmitt, *Pl. Mont.* 191: 581 (1999). TYPE: China, Xinjiang: Habahe Co., 1,100 m, *Larix* forests, 2 Sep. 1974, Y. R. Ling 1141 (holotype PE!).

Paeonia altaica K. M. Dai & T. H. Ying, *Bull. Bot. Res. Harbin* 10(4): 33, fig. 1 (1990); Schmitt, *Pl. Mont.* 191: 582 (1999). *Paeonia veitchii* Lynch subsp. *altaica* (K. M. Dai & T. H. Ying) Halda, *Acta Mus. Richnov., Sect. Nat.* 4: 29 (1997); Halda, *Gen. Paeonia*, 106 (2004). TYPE: China, Xinjiang: Habahe Co., Wuzliti, 1,550 m, in forests, 10 June 1986, T. H. Ying 1007 (holotype SHMU!; isotype PE!).

Paeonia anomala var. *insignis* Lynch, *J. Roy. Hort. Soc.* 12: 435 (1890), syn. nov. TYPE: not designated.

Paeonia anomala L. var. *nudicarpa* Huth, *Bot. Jahrb. Syst.* 14(3): 269 (1891). TYPE: not designated.

Paeonia anomala L. var. *typica* Regel Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 34: 125 (1861). TYPE: not designated.

Paeonia anomala L. var. *angustifolia* Krasnob., *Sist. Zametki Mater. Gerb. Krylov Tomsk. Gosud. Univ. Kuybysheva* 85: 2 (1974), syn. nov. TYPE: Russia. Sajon occid. Alan, Taskalyk, 1,700 m, 25 June 1970, I. Krasnoborov s.n. (holotype NS, n.v.).

PHENOLOGY. Flowering from late May to mid July; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (Barber, 1941; Kartashova *et al.*, 1974; Krogulevich, 1978; Langlet, 1927; Pan *et al.*, 2006; Stebbins, 1938a; Stern, 1944; Yakovlev & Yoffe, 1965).

HABITATS. Usually found in deciduous or coniferous forests in valleys, less frequently in meadows, from lowlands to an altitude of 2,400 m. Apparently it prefers relatively moist sites on limestones or granites.

DISTRIBUTION. A very wide distribution: NE Kazakhstan, NW and C Mongolia, from the Altai and Baikal to the Kola Peninsula in Russia, and in the Altai and adjacent regions in Xinjiang, China (Map 5.14).

NOTES. In the typical subspecies of *Paeonia anomala*, the leaflets or leaf segments are always covered with bristles along the veins above, but always glabrous beneath. The sepals are hispidulous only at the top on the adaxial side, and always glabrous on the abaxial side; the carpels number mostly five, less frequently four or three.



Fig. 5.14A. *Paeonia anomala* L.: a, the lower part of the plant, showing carrot-shaped roots and a short caudex; b, the middle part of the stem with a lower leaf; c, the upper part of the plant with a flower; d, the upper surface of a leaf, showing bristles along veins. Drawn by Miss LI Ai-Li.

ADDITIONAL SPECIMENS EXAMINED. CHINA, XINJIANG, Altay: *s. loc.*, L. R. Xu s.n. (PE); *s. loc.*, 27 Aug. 1956, R. C. Ching 2496 (PE); Qiao'ati, 1,550 m, 19 Aug. 1964, G. L. Zhu 6325 (PE); Xiaodonggou valley, 1,060 m, in forests, T. H. Ying 1001 (PE, SHMU); *loc. eodem*, in *Populus–Betula–Picea* forests, 4 June 1993, D. Y. Hong *et al.* Population No. 5 (PE); *loc. eodem*, 1,300 m, 24 Aug. 1986, J. R. Chen 86103 (PE); Mt Halamaryi, 1,200 m, in *Populus* forests by streams, 3 June 1993, D. Y. Hong *et al.* Population No. 3 (PE) and 0128 (PE); *loc. eodem*, 1,300–1,700 m, *Acad. Sin. Xinjiang Exped.* 2496 (PE, XJBI); *loc. eodem*, 1,060 m, 18 May 2002, J. F. Mao, J. Pan & C. Wang XJ004 (PE); Aleati, slopes, 3 Aug. 1967, J. N. Liu s.n. (PE). **Burqin**, Kem, 1,200 m, N. R. Cui 86624 (XJNU). **Emin**, Shiyue Township, Wuerkehe'er, right bank of Telikete River, N slopes, 1,200 m, *Acad. Sin. Xinjiang Branch* 012 (XJBI). **Fuhai**: Daqiao Forest Farm, 2,000 m, in *Populus–Betula* forests, 28 June 1986, T. H. Ying 1011 (PE, SHMU); *loc. eodem*, at the edges of *Betula* forests, 1,550 m, 26 Aug. 1986, T. H. Ying 995 (PE, SHMU) and 28 June 1986, T. H. Ying 1014 (PE, SHMU); Fuhai Forest Farm, G. L. Zhu *et al.*, 5755 (PE); Ahebai, glades, 2,000 m, *s. coll.* 3867 (XJBI). **Fuyun**: *s. loc.*, C. W. Chang 11356 (XJBI); *s. loc.*, 1,200 m, *Betula* forests, 13 Aug. 1956, R. C. Ching 1803 (PE); near the town, N of river, 3 Aug. 1956, *Xinjiang Exped.* 218 (PE). **Habahe**: Wuzlity, in forests, 27 Aug. 1986, T. H. Ying 1022 (PE, SHMU); *loc. eodem*, 1,550 m, *Betula* forests, 10 June 1986, T. H. Ying 1008 (PE); *loc. eodem*, Tiekeliti, 1,400 m, in *Betula* forests, 9 June 1986, T. H. Ying 1010 (PE, SHMU); *loc. eodem*, Timber Inspection Station, 1,200 m, in valley forests, 8 June 1986, T. H. Ying 1006 (PE, SHMU); Tiekeliti, 1,650 m, in *Betula* forests, T. H. Ying, 1009 (PE, SHMU); Baihaba, 1,300 m, in forests, Z. M. Mao 10413 (XJBI); *loc. eodem*, 1,200 m, C. W. Chang *et al.* 4357 (XJBI); Tielieke, Zamanashi Valley, in bushes, 1,100 m, C. W. Chang *et al.* 10255 (XJBI). **Jeminay**, Xingfu Township, Sanxie Valley, 1,600 m, *Integrated Exped.* 7305 (XJBI) and 10563 (XJBI). **Qinghe**, Daqinghe, Mudeng Valley, in shrubby meadows, *Integrated Exped.* 11829 (XJBI). **Tacheng**, Mt Ba'erleike, 1,210 m, X. Y. Li 870147 (SHI). **Toli**: Mt Zayier, N slope, meadows with shrubs, 1,400 m, *Integrated Exped. (Biol.)* 630 (XJBI); Jiayi'er Gold Mine, 1,600 m, N. R. Cui 091 (XJNU). **Wenquan**, A'erxiaotogou, 1,750 m, F. M. Zhang 90-346 (XJNU). **Yumin**, Ku'erzhai, meadows with shrubs, 1,200 m, Liu & Shen 8308 (XJBI). **KAZAKHSTAN, SEMIPALATINSK PROV.**, Altai, near Altaiskaya Station, Naryn Mts, on slopes, 1,900 m, 25 June 1899, *Ladygin* 92 (LE). **S ALTAI**, Ivanov Mts, near Gorno-Ulbinki, in *Abies* forests, 23 July 1960, I. Rohderi s.n. (LE). **USTKAMENOGORSK REGION**: Naryn Mts, upper reaches of Urkar River, in *Larix* forests, 11 June 1912, V. Reznichenko 58 (LE); Urunhaika River mouth, S bank of Markakul Lake, in *Larix* forests, 8 July 1908, A. Sedelnikov s.n. (LE); near Ulbinsky, gorge with tall grasses, 28 May 1909, V. Iljin s.n. (LE); Altai Mts, Kunduzda Valley, in middle reaches, meadows, 26 July 1909, V. & A. Reznichenko 360 (LE); Mt Kalbin, Saryshbay Valley, in middle reaches, 3 July 1913, V. Reznichenko 49 (LE); Mt Kalbin, Ulansky, near Asybulak, by Tainta River, in forests, 28 May 1939, P. Yurchenko s.n. (LE). **ZAISAN REGION, Naryn Mts**, Ak-tui Valley, 2,000 m, in bushes on the edges of forests, 2 July 1914, D. Yakovlev 69 (LE); Markakul Lake, in forests, 6 Aug. 1908, B. Keller s.n. (LE); *loc. eodem*, meadows, Aug. 1908, B. Keller s.n. (LE). **Altai Mts**, Ulkunchumek Valley, upper reaches of Kaldzhir River, 23 June 1908, V. Reznichenko 106a (LE) and 106b (LE). **Mt Saur**: Maly Dgwen Gorge, woody slopes, 1 Aug. 1908, B. Keller s.n. (LE); *loc. eodem*, meadows, 1961, I. Grudzinskaya s.n. (LE); Chagan-obo Valley, 11 June 1900, V. Reznichenko s.n. (LE). **MONGOLIA, ARKHANGAI PROV.**, 25 km SSE of Teviueulekha, Khukh-sum Valley, *Larix* forests on NE slopes, 12 June 1972, E. Isachenko 1387 (LE). **ARA-KHANGAI PROV.**, Barun Gun Village, Abzog ula, S stony slopes, clearings of *Larix* forests, July 1929, E. Kuznetsov 17338 (LE). **BULGAN PROV.**: Saikhan Village, Modon khutil', 10–12 km NNW of the village, *Larix* forests, 11 July 1949, A. Yunatov 12144 (LE); Unot Village, 24 Aug. 1961, D. Banzragch & T. Dugar 364 (LE). **DZABHAN PROV., Guriyn Mts**, 2,400 m, *Larix* forests with mosses and *Vaccinium vitis-idaea*, 4 Aug. 1972, D. Banzragch *et al.* 4249 (LE). **Khangai**: in *Larix* forests, by Tzytzerlik River, on summit, 60 km above river mouth, Aug. 1926, Pavlov 398 (LE); *Larix* forests, 6 km from Zain-shabi, 17 July 1926, N. Ikonnikov-Galitzky 424 (LE); Telyin-gol Valley, on road Gulgan-

Taralyan, 4 km above the bridge, right side, *Betula-Larix* forests on N slopes, 19 July 1972, *V. I. Grubov, N. Ulzikhutag, L. Demorzhev & D. Tzetzegmaa* 78 (LE); Selenga Basin, 35 km S of Selenga Village, N slopes with birch forests, 14 July 1971, *N. I. Dorofeyuk* 304 (LE); near summit of Khalzan Pass by Zaingehgen, in *Larix* forests, 3 Aug. 1926, *Pavlov* 332 (LE); N Khangai, 1877, *G. N. Potanin* s.n. (G); N Khangai, Ridge of Buren-Nuru, along Khangol River, on right side of road to Ehrdehnet Bridge on Selenga River, N slope, on rocks in forests, 23 July 1979, *V. I. Grubov, A. Muldashev & S. Darijma* 677 (LE); N Khangai, left bank of Tehsiin-gol River, 14 km below bridge on Ulyasatay road, *Larix* forests on N slopes, 14 Aug. 1972, *V. I. Grubov, N. Ulzikhutag, L. Demorzhev & D. Tzetzegmaa* 882 (LE); between Mogoi-daban Pass and Subur-Khairkhan summit, *Pinus sibirica-Larix* forests, 7 Aug. 1926, *J. Prokhanov* 436 (LE). **Khara-gol Basin:** Tyrghtuj Ridge, in mixed forests, 21 June 1903, *M. I. Molleson* s.n. (LE); between Kyakhta and Urga (now Ulan-Bator), pass between Bain-gol and Karagol Rivers, in *Betula* forests, 19 June 1912, *V. Smirnov* 423/1277 (LE); *loc. eodem*, 19 June 1912, *V. Smirnov* 1280 (LE); *loc. eodem*, 19 June 1912, *M. P. Tomin* 29b (LE); Dondu Tamir Valley, in *Larix* forests, 4 June 1894, *E. K. Klements* 74 (LE); *loc. eodem*, in *Larix* forests on slopes, 4 June 1894, *E. K. Klements* 74a (LE); Dzul-ayudo Golden Mine, Yulla Valley, near forests, 11 June 1923, *A. G. Gnadeberg* 09 (LE); Khangai, Urdu-Tamir Basin, Tzetzlerleg-gol Valley, near the bridge, *Larix* forests, 10 July 1970, *V. I. Grubov, N. Ulzikhutag & G. Tzerenbalzhid* 47 (LE). **Toson-tzeasgel**, pass 9 km SE of the village, *Larix* forests, 25 June 1977, *Z. V. Karamysheva, G. Sanchir & I. Y. Sumerina* 207 (LE). **GLOUCESTER**, Mongolia-Chinese Turkestan Exped. 1910, *M. P. Price* 293 (K). **N MONGOLIA**, Saldzharsky Mountain Pass, 21 June 1898, *E. K. Klements* 11a (LE). **NW MONGOLIA: Bait-kure**, Mt Darkhyt, N slope of Khan-ko-ko Ridge, 9 June 1924, *M. Neiburg* s.n. (LE). **PRIKHUBSUNUR PROV.:** Ehgin Basin, Urtuin-daba on road from Ehrdeni-Bulan to Tzagan-ur, *Larix* forests, N slope, 22 July 1972, *V. I. Grubov, N. Ulzikhutag, L. Demorzhev & D. Tzetzegmaa*, 150 (LE); Tes Village, Zankhon, 4 km W of the village, Tes Valley, *Larix* forests, 24 July 1974, *Banzragch, Gambold, Mumbayar & Damba* 5667 (LE). **SELENGA PROV.:** Barun-Buryn Village, watershed between Burgultai and Khangai Rivers, N slopes, clearings in *Larix* forests, 2 Aug. 1949, *A. V. Kalinina* s.n. (LE); Selenga, Orkhon-Selenga watershed, N slopes, clearings of forests, 2 Sep. 1931, *N. L. Desyatkin* 449 (LE); upper reaches of Nogoi River, on summit, 3 June 1893, *E. K. Klements* 78d (LE); between Ust'-Kyachta and Urga (Ulan-Bator), way to Khara-gol River, open *Betula* woods, 19 June 1912, *M. P. Tomin* 28b (LE); Urdu Tamikhyn-gol River, Mt Khantygoityn, N slopes, 25 June 1925, *A. Burdukova* s.n. (LE). **UBSUNUR PROV.:** Mongolian Altai, Shur-Ulyastaj-gol Valley, grassy *Larix* forests, 12 July 1973, *D. Banzragch, Z. V. Karamysheva, S. Munkhbayar & T. Tzehgmid* 4583 (LE); Barun-Turun Khan-Khukhei Ridge, 32 km S of Barun-Turun, N slope, *Larix* forests, 23 July 1973, *D. Banzragch, Z. V. Karamysheva, S. Munkhbayar & T. Tzehgmid* 4947 (LE). **UBURKHANGAI PROV.:** Bat-ulzitu Village, Orkhon Valley, below Ulan-tzutkhulan waterfall, on stony river banks, 11 July 1952, *T. Davazhamtz* s.n. (LE). **ULAN BATOR**, 15 km E of Ulan Bator, 2,200 m, 7 July 1978, *P. Morgan* 23 (K). **RUSSIA, ALTAI REGION, Altai:** *s. loc.*, *Kopteeb* 214 (WU); alpine Altai, *M. Patrin* s.n. (G); between Charga and Shabolina, slopes, 10 June 1898, *E. K. Klements* 4d (LE); Chuja road, Saadak-lary, 21 July 1908, *V. Vereshagin* 296 (LE); Kuraiskii Chrebet, 50°19'N, 87°43'E, 1 Aug. 2002, *M. Staudinger* 5507 (W). **W Altai**, Mt Listvennitchny, near Nizhne-Uimonskoye, *Larix* forests, 11 Aug. 1953, *S. Kolomoitseva* 236 (LE). **Biisk:** between Tulatinskaya and Sentelek, 13 July 1913, *N. Kuznetsov* 1991 (LE); Black Anuj, Talitskiebelky, on way to Kazanda, mixed forests, 10 Aug. 1929, *Pobedimova* 697 (LE); Lebed Valley, by Chuja River, *Abies-Cedrus* forests, 30 July 1908, *B. Klopotov* 180 (LE). **ARKHANGELSK PROV.:** Pinezhski region, in forests, 1899, *Pohle* s.n. (LE). Pinega Basin, by Yula River, in forest glades, 25 July 1928, *A. Zubkov* s.n. (LE); Pinega Basin, by Sura River, pine woods, 19 June 1928, *A. Zubkov* s.n. (LE). Kanin Peninsula, middle reaches of Nattey River, meadows, 11 July 1945, *V. Matveev* s.n. (LE). Severnaya-Dvina Basin, above Olem River mouth by Vym River, 14 July 1929, *V. Andreev* 74 (LE). **BURYATO-MONGOLIAN AUTONOMOUS STATE, Baikal:** Tunkam, subalpine forests, 1830, *Turczaninov* s.n. (LE); near Baikal, on mountains, *S. Shukin* s.n. (LE). **Zabaikalje**, upper reaches of Toreika

River, 130 km W of Troitskosavsk, forests, 20 July 1928, *P. Mihno* s.n. (LE). **EUBINSK REGION, W Sayan:** Alan Mountain Range, Golets Taskalyk, 1,700 m, subalpine *Cedrus* forests, 26 June 1970, *I. M. Krasnoborov* 6765 (LE); near Buiba Station, by river, 15 June 1965, *I. M. Krasnoborov & Sannikova* s.n. (LE). **IRKUTSK REGION,** near Irkutsk, in taiga, July 1969, *Le Fleming* s.n. (K). Lena Valley, upper reaches of Gulm River, meadows, 30 May 1910, *I. Kuznetsov* 114 (LE). **Balagansky Distr.,** near Bazheevskoye, 10 June 1902, *N. Maltsev* 79 (LE). **Nizhneudinsk Distr.:** by Oka River, 19 June 1910, *A. Krishtofovich* s.n. (LE); near Vidimka, meadows by Vidim River, 17 June 1911, *S. Kucherovskaya* 282 (LE); by Angara River, opposite Yandov, *Pinus–Larix* forests, 12 June 1909, *S. Ganeshin* s.n. (LE); Hariba-bim Mountain Range, Angara Valley, Karpovskoye, 14 July 1931, *A. Korovkin* 290 (LE). **Tunkinsky Distr.:** Kuren Arshan, *Larix–Pinus–Betula* forests, 1936, *V. Smirnov* s.n. (LE); Sayany Mountains, near Nylova Pustyn, 5 June 1962, *V. L. Komarov* s.n. (LE); Nizhnaya Tunguska Valley, near Nizhnaya Korelina, meadows, 12 June 1908, *S. Kokulin* 254 (LE). **Verkholensk Distr.:** Lena River and Kirenga Valley, meadows by Toptykan, 17 June 1909, *M. P. Tomin* 67 (LE); Harat, coniferous forests, 13 June 1911, *G. Dolenko* 108 (LE); Biriulka, near Yushina, meadows, 11 June 1911, *P. Alexandrov* 179 (LE); Tutura, forests, 7 June 1910, *P. Alexandrov* 219 (LE). **KIROVSK PROV.:** Afanasjevo, Kalich River and its tributaries, *S. Zarubin* s.n. (LE). Ponoy River, left bank, 8 km from the mouth, meadows on rocky slopes, 3 July 1953, *E. Chernov* 3 (LE); *loc. eodem*, near Ponoy River mouth, *N. Orlova* s.n. (LE). Lapponia, Ponoy, 1863, *N. I. Fellman* s.n. (G, K); *loc. eodem*, 22 July 1899, *J. Montell* s.n. (G, K, P, WU); *loc. eodem*, 3 July 1880, *R. Enwald & C. A. Knabe* s.n. (G, K); Rusinika, 16 July 1889, *A. O. Kihlman* 254 (WU). **KOMI REPUBLIC:** Kozhva Basin, near Kamenka River mouth, meadows on limestones, 17 Aug. 1935, *A. Levkov & I. Maskil* 218 (LE). Pechora River, upper reaches, near Elma River mouth, in *Betula* forests, 31 July 1927, *F. Sambuk* s.n. (LE). Mezen River, upper reaches, near Makariyev, 14 Aug. 1929, *E. Ispolatov* s.n. (LE). Inta Region, right bank of Usa River, near Adak, 26 May 1959, *T. Sergeeva* 65 (LE). Inta Station, edges of forests, 27 June 1964, *I. Grom* s.n. (LE). Vym Basin: by Komi River, in *Larix–Betula* forests, 19 July 1934, *N. Dylis* 195 (LE); by Yelva River, in *Larix* forests, 5 July 1930, *N. Temnoev* s.n. (LE). Pechora Region, Pizhma River, July 1909, *B. Nikolaevsky* s.n. (LE). Timanskaya tundra, N Bolvanskaya sill, on slopes, 22 July 1928, *A. Dedov* s.n. (LE). **KRASNOYARSK REGION, ENISEI PROV., Achinsk Distr.:** near Ingol Lake, 11 June 1911, *A. Suhareva* s.n. (LE); near Maloye Lake, 25 May 1914, *M. Ermolajeva* s.n. (LE); Bolshe-Uluiskaya, near Bobrovki, *Populus–Picea–Abies* forests, 28 May 1912, *I. Kuznetsov* 53 (LE). **Belsk Distr.:** near Alshat, edges of mixed forests, 26 June 1914, *I. Kuznetsov* 4661 (LE); Rybnoe, 26 May 1910, *Dranitsyn & Kochubei* s.n. (LE); Chadobets, *Pinus–Betula* forests, 13 June 1909, *G. Borowikow* s.n. (LE). Chuksha Valley, mixed forests, 23 June 1908, *I. Tolmatschew* 247 (LE); Katanga, 8 Aug. 1910, *G. Borovikov* s.n. (LE); Vyezzi Log, 7 June 1912, *A. Tugarinov* s.n. (LE). **Kansk Distr.:** Rybnaya Valley, Perovskoye, bushes, 30 May 1911, *I. Kuznetsov* 193 (LE); Gutar Valley, by Kamenka tributary, 11 June 1913, *W. Troitsky* s.n. (LE); near Kansk, 8 June 1902, *A. Shliahtin* s.n. (LE); near Nazimovskoye, bushes by river, 4 June 1914, *Z. Evseeva* 4406 (LE). **KRASNOYARSK PROV.:** Minusinsk, Bolshoye Kysylkul Lake, 14 June 1959, *K. Golubeva et al.* s.n. (LE); near Krasnoyarsk, by Mohovaya River, 9 May 1911, *V. Verhovskaya & M. Mishin* 104 (LE); near Sorokino Station, N slopes, 16 June 1959, *Cherepnin* s.n. (LE); Hakassia, Shirinsky Distr. Bolshaya Iiusa Valley, NW slopes, 7–11 June 1962, *Polozhii & Kandasova* s.n. (LE); Chunia River, right bank opposite mouth of Mutorai River, bushes at edges of *Betula* forests, 28 July 1931, *A. Rubin* s.n. (LE); Nizhnaya Tunguska Valley, near mouth of Hurkakit River, bushes at forest edges, 18 Aug. 1932, *Rubin & Maskil* s.n. (LE). **Shushensky Distr.:** near Tanzyben, by Black Tanzyben River, 2 June 1964, *Kuminova & Alexeeva* s.n. (LE). Between Salba and Grigorievka, glades in *Betula* forests, 3 June 1892, *P. Krylov* s.n. (LE). **NOVOSIBERIA REGION, Altai:** Elikmanar, upper reaches of Karakol River, in forests, 1 July 1911, *V. Vereshagin* 345 (LE). **MARIINSKY PROV., Tomsk Distr.,** Chulym and Chet Valley, May 1901, *P. Sokolov* 13a (LE). **Mariinsky Distr.,** Beket Valley, Kolsonskoye, 7 June 1912, *N. Kuznetsov* 199 (LE). **Tarsky Distr.,** Rybinsk, near Pustynnoye, 27 June

1913, *V. Varentsov* s.n. (LE). **TOMSK PROV., Kainsk:** Verhnyaya Nazarova, forest glades, 10 July 1913, *B. Klopotov* 113 (LE); Naryn, middle reaches of Ixa River, *Betula* forests, 5 Aug. 1912, *S. Genina* s.n. (LE); near Tomsk, Sofronova, 22 June 1886, *P. Krylov* s.n. (LE). **Kuznetsky Alatau:** Kondoma Valley, Kazany Mine, Mt Kyon, woody slopes, 30 May 1909, *B. Klopotov* s.n. (LE); upper reaches of Sary-Chumysh River, near Ulus Munai, coniferous forests, 3 June 1908, *A. Vydrin* s.n. (LE); Tom Valley, Mt Tohpan-taiga, subalpine meadows, 27 June 1909, *B. Klopotov* s.n. (LE). **Moshkovsky Distr.,** Uskorniha Valley, bushes, 1 June 1962, *Kuvajev & Sabitov*, s.n. (LE). **Toguchinsky Distr.,** near Mirny, *Pinus* forests, 2 June 1974, *Lashinsky & Ronginskaya* 973 (LE). **OMSK REGION, KURGANSKAYA PROV., Petukhovsky Distr.,** Medvezhje Lake, W part of northern peninsula, *Pinus* forests with *Tilia*, 17 June 1999, *N. Naumenko* 313 (LE). **PERM PROV., s. loc.,** forests, *F. Teplouhov* 355 (LE). **KRASNOUFIMSK REGION:** Shani, coniferous forest, on rocks, 2 Aug. 1887, *S. Korzhchinsky* s.n. (LE); between Salva and Vogulka, pine woods, 6 June 1895, *N. Skalozubova* s.n. (LE). **Tihonsky Kamen,** 22 June 1876, *P. Krylov* s.n. (LE). **Verhne-Chusovskaya Distr.,** Popovo, *K. Igoshina* s.n. (LE). **TOBOLSK PROV., Berezovsky Distr.,** Berezov, 18 June 1913, *Pohle & Rozhdestvensky* s.n. (LE); Lopsia River, tributary of Severnaya Sosva, 4 June 1904, *D. Iljin* s.n. (LE); Tobolsk Distr., Landinka Valley, 7 Aug. 1914, *I. K. Vislouh* 73 (LE). **W Siberia:** Tobolsky gubernia, Berezovsky uezd (now Khanty-Mansi Republic), Lopsiya, confluence of Northern Sosva River, 4 June 1904, *D. Iljin* s.n. (LE); *loc. eodem*, 31 May 1904, *D. Iljin* s.n. (LE); Ob' Basin, near Surgut, between Surgut and Agan River mouth, Pohekujka River mouth, *Populus tremula* and *Pinus* forest, 23 June 1923, *B. N. Gorodkov* s.n. (LE). **TUVA, Ehrzinsky Distr.,** Tes Basin, 63 km from Naryn Village on road to Kachik, 1,800 m, *Larix* forests, N slopes, 22 July 1972, *I. Krasnoborov & N. Bezzyzykova* 165 (LE); Mt Enisei Basin, upper reaches of its right confluence Kopto River, near former gold mine Kopto, S slopes near summit of ridge, granites, 13 July 1975, *I. M. Krasnoborov & I. Krasnoborov* 1233 (LE). **Kaa-Khemsky Distr.,** near Iljinka Village, right bank of Soya River, *Betula-Larix* forests, 14 July 1972, *E. Pen'kovskaya & L. Eremenko* 1122 (LE). **Tandinsky Distr.,** E end of Tannuola Mountain Range, 1,230 m, near Shurmak, 31 May 1972, *V. Khanminchun* 515 (LE). **Tes-Khemsky Distr.,** S slope of E Tannu-Ola Ridge, 2,100 m, near Khol'-Ezhu Village, *Pinus-Larix* forests, 12 June 1972, *V. Khanminchun & A. Andreev* 514 (LE). **Ulug-Khemsky Distr.,** Uiuksky Mountain Range, Bajan-Kol Valley, Orto-Hem tributary, *Pinus-Larix-Betula* forests, 21 July 1976, *Lomonosova & Ivanova* 89 (LE). **UFA PROV., Zlatoust Region,** Mt Nurgush, near Tiuliuk, June 1892, *O. & B. Fedchenko* s.n. (LE). **URAL: s. loc.,** 20 June 1895, *T. Teplonkhov* s.n. (WU); *s. loc.,* 3 June 1893, *T. Teplonkhov* s.n. (WU); Exped. Uralensis, *s. loc.,* 4 June 1847, *Branth* s.n. (LE). **Arctic Ural:** Severnaya-Sosva Valley, upper reaches of Khulga River (Lyapin tributary), 16 Aug. 1926, *B. Gorodkov* 512 (LE); upper reaches of Manja River (Lyapin tributary), edges of forests, 26 June 1927, *V. Sochava* 100 (LE). **Ivdel,** along Ivdel River, 5 km from Ivdel, limestones, 26 June 1971, *K. Igoshina* s.n. (LE). **Pavda,** Mt Bely Kamen, 15 Sep. 1926, *V. Petrova* N39C (LE). **Sretenskoje:** 20 July 1895, *T. Teplonkhov* s.n. (WU); *loc. eodem*, 28 July 1895, *T. Teplonkhov* s.n. (WU). **Tulpan,** Mt Pres Merki, 23 Apr. 1895, *M. T. Chaffanjon* s.n. (G). **YAKUTSK AUTONOMOUS STATE, YAKUTIA, Suntarsky Distr.,** upper reaches of Vilyuy River, Tuoikhaia, by Chona River, 7 Sep. 1958, *I. Kildushewsky* 150/22 (LE).

14b. *Paeonia anomala* subsp. *veitchii* (Lynch) D. Y. Hong & K. Y. Pan in Hong *et al.*, *Novon* 11(3): 317 (2001); Hong & Pan, *Ann. Missouri Bot. Gard.* 91(1): 93 (2004); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 132 (2001). Basionym: *Paeonia veitchii* Lynch, *Gard. Chron.* n. ser. 46: 2, fig. 1 (1909); Stern, *J. Roy. Hort. Soc.* 68: 130 (1943); Stern, *Study Gen. Paeonia*, 115 (1946); Pan, *Fl. Reip. Pop. Sin.* 27: 56, pl. 9 (1979). TYPE: China, W Sichuan: Taitien-lu [Kangding], 2,440–3,050 m, *E. H. Wilson* (for James Veitch & Sons) 3034 (holotype K!; photo PE!).

Paeonia beresowskii Kom., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 5 (1921). *Paeonia veitchii* Lynch var. *beresowskii* (Kom.) Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 46 (1921).

TYPE: China occid., Szechuan [Sichuan]: Sun-pan-tin (Songpan), c. Guichua, 9 June 1894, *M. Beresowskii* s.n. (holotype LE, n.v.).

Paeonia veitchii Lynch var. *woodwardii* (Stapf ex Cox) Stern, *J. Roy. Hort. Soc.* 68: 130 (1943); Stern, *Study Gen. Paeonia*, 117 (1946). Basionym: *Paeonia woodwardii* Stapf ex Cox, *Pl. Introd. Farrer*, 43. 1930. *Paeonia veitchii* Lynch subsp. *veitchii*-var. *woodwardii* (Stapf ex Cox) Halda, *Gen. Paeonia*, 106 (2004). TYPE: China, Gansu: Zone [Chuoni], s.d., R. Farrer 67 (holotype E!).

Paeonia veitchii Lynch var. *leiocarpa* W. T. Wang & S. H. Wang ex K. Y. Pan, *Fl. Reip. Pop. Sin.* 27: 603 (1979). TYPE: China, Sichuan: Jinchuan, Kasa Township, Yinchanggou, forests by stream, 2,700 m, 26 Apr. 1958, X. Li 77248 (holotype PE!).

Paeonia veitchii Lynch var. *uniflora* K. Y. Pan, *Fl. Reip. Pop. Sin.* 27: 603 (1979). TYPE: China, Sichuan: Garzê, Xiongjiling, 3,600 m, mountain summit, bushes, 18 June 1974, Qinghai-Xizang Exped. Vegetation Group 034 (holotype PE!).

Paeonia veitchii Lynch var. *purpurea* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 46 (1921). TYPE: not designated.

PHENOLOGY. Flowering from late April to early June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (Dark, 1936 (under *P. beresowskii*); Hong *et al.*, 1988; Sax, 1937; Stebbins, 1938a; Stern, 1944; Zhang & Sang, 1999).

HABITAT AND DISTRIBUTION. Like the typical subspecies *anomala*, the subspecies *veitchii* prefers relatively moist habitats, growing in forests, grasses on the edges of forests, bushes, or subalpine and alpine meadows with shrubs, on limestones, at altitudes from 1,800 to 3,870 m. Widely distributed in China: SE and C Gansu, S Ningxia, E Qinghai, Qinling Range of Shaanxi, Shanxi, W Sichuan, NE Yunnan and the eastern extreme of Xizang (Tibet) (Map 5.14).

NOTES. This subspecies very much resembles *P. anomala* subsp. *anomala*, though distantly isolated from the latter by the huge Gobi and other deserts. The only remarkable difference between them is the number of flowers on a stem. *Paeonia anomala* subsp. *veitchii* usually possesses two to four blooming flowers in addition to one or two sterile axillary flower buds, or very rarely, there are one to three sterile axillary flower buds in addition to the terminal blooming flower. The typical subspecies usually possesses a single terminal blooming flower, without or infrequently with one to two sterile axillary flower buds; very occasionally two flowers are present on a stem.

Leaflets or segments in *P. anomala* subsp. *veitchii* are always covered with bristles along veins above, glabrous or rarely hispidulous along veins or margins beneath. Sepals are hispidulous only at the top on the adaxial surface, glabrous or rarely hispidulous entirely or along veins on the abaxial side; petals are red, pale red, rose to white. Carpels number mostly three, less frequently two or four, rarely one, and are usually tomentose, but we found that tomentose and glabrous carpels did coexist within the single population (D. Y. Hong, Y. B. Luo & Y. H. He H95034) in Lixian, Sichuan Province.

ADDITIONAL SPECIMENS EXAMINED. CHINA, GANSU, Dingxi, *s. loc.*, Aug. 1972, *s. coll.* s.n. (CPB). Hezheng, Xinzuang, 30 Sep. 1971, *Gansu Herbs Group* s.n. (NWTC). Hezuo, Mt Dalinke, *Picea* forests, 3,300 m, 10 Sep. 1979, Q. R. Wang 7034 (NWTC). Jiangcha, mixed forests, 2,860 m, 17 July 1964, *S Gansu Grassland Exped.* 681 (NWTC). Kangle: Mt Taizi, 2,500 m, 6 July 1980, G. L. Zhu 80006 (NWTC) and 80077 (NWTC); Mt Lianhua, 2,200 m, 19 June 1986, M. S. Yan 1843 (NWTC). Kangxian, *s. loc.*, Aug. 1958, *s. coll.* s.n. (NWTC). Lanzhou: Mt Xinlong, *s. coll.* 84 (NWTC); Mt Tiandu, *s. coll.*, s.n. (NWTC). Linxia, near Senanpa, 2,500 m, by rivers, 28 June 1937, T. K. Fu 834 (PE). Longdie: Dacapo, 2,600 m, 20 June 1959, H. J. Zhou 708 (NWTC); *loc. eodem*, 24 June 1959, X. F. Long 85 (NWTC). Minxian: *s. loc.*, *s. coll.* *Gansu* 557 (PE); Lujing, Zhongchuangou, 12 Aug. 1978, J. Q. Wang 197 (NWTC); Mt Luodadoudjidel, 3,000 m, grassy slopes, 10 June 1951, T. P. Wang 15240 (PE); near Mawu, 2,400 m, grassy slopes or thickets, 26 July

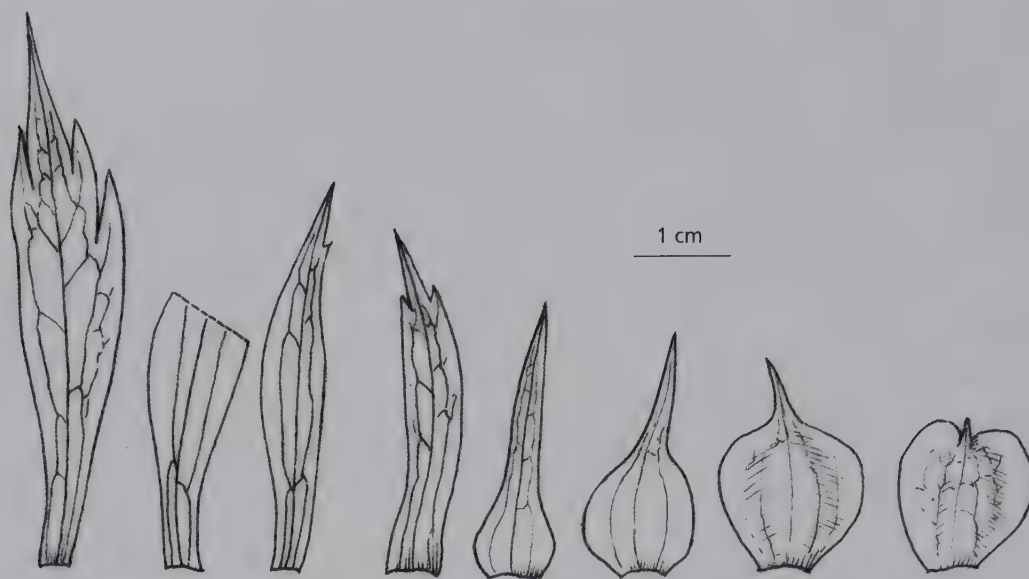


Fig. 5.14B. *Paeonia anomala* L. subsp. *veitchii*: involucre bracts and sepals, based on D. Y. Hong, K. Y. Pan & H. Yu H04032 (PE). Drawn by Mr SUN Yin-Bao.

1936, T. P. Wang 4594 (PE); between Lintao and Yuzhong, mountain slopes, 22 July 1956, *Huanghe Exped.* 1689 (PE); Mt Wutai, 2,540 m, mountain summit, bushes, 27 May 1957, *Taohe Exped.* 3243 (PE); Lamathan, 3,000 m, 4 July 1930, K. S. Hao 604 (PE). **Taohe**: *s. loc.*, 2,740 m, *Picea* forests, July 1925, J. F. Rock 12829 (PE); Tsaluku to Shimen, 3,050 m, alpine meadows, Aug. 1925, J. F. Rock 13127 (PE); *loc. eodem*, 3,050 m, alpine meadows or scrub forests, June 1925, J. F. Rock 12260 (PE). **Tianshui**, Mt Xinjia, 2,200 m, 6 July 1939, W. Y. Hsia 5707 (PE). **Tianzhu**: Anyuan, 2,800 m, 7 July 1959, Y. Q. He 4516 (PE); Zhucha, 2,900 m, 15 July 1959, Y. Q. He 4915 (PE); Jinqiang Township, Mt Maomao, 8 Apr. 1960, Q. R. Wang 1869 (NWTC). **Xiahe**: Chingshui, 2,600 m, bushes, 1 July 1937, T. P. Wang 6944 (PE); Tangar'ang, Longwagou, 3,000 m, 18 Sep. 1979, Q. R. Wang 7270 (NWTC). **Yongdeng**: Liancheng, Tulugou, 1 May 1986, J. L. Bai 8613 (NWTC); *loc. eodem*, 2,500 m, 17 July 1987, Chen & Ju s.n. (NWTC). **Yuzhong**, Xinlong, near Yangdaowan, 2,150 m, 31 Aug. 1956, *s. coll.*, s.n. (PE). **Zhangxian**: Caotan Distr., 11 July 1956, *Huanghe Exped.* 03183 (PE); Mt Guiqing, 11 June 1956, *Huanghe Exped.* 4735 (PE); Hediling, Mt Kehu, 11 June 1956, *Huanghe Exped.* 4655 (PE); Shichuan Forest Farm, Jinhuaichi, 3,000 m, forests, 6 Sep. 1979, Lian, Wang et al. 79197 (NWTC). **Zhouqu**, Taozhou Forest Farm, 2,500 m, shady slopes, forests, 21.5.1959, Jiang & Jin 00386 (PE). **Zone (Chuoni)**: *s. loc.*, 2,800 m, bushes, 24 July 1937, T. P. Wang 5343 (PE); Mu'ercun Village, S bank of Taohe River, 2,570 m, 13 June 1957, *Northwest Univ.* C0025 (PE); Kache Forest Farm, 3,000 m, 3 June 1986, Lian & Chen 31 (NWTC); Wanchang, Sangtanagou, 3,200–3,300 m, Lian & Chen 72 (NWTC). **NINGXIA**: the Liupan Mt Range, 2,400 m, shady slopes, 13 June 1953, Y. W. Cui 10281 (PE); the same range, 2 July 1936, K. M. Liou 5659 (PE); *loc. eodem*, 8 Aug. 1956, *Huanghe Exped.* Gansu First Team 02168 (PE). **QINGHAI, Datong**: Kuanghuizu, 1,970 m, *Picea* forests, 24 July 1936, K. M. Liou 6019 (PE) and 6044 (PE); *loc. eodem*, 1,990 m, *Picea* forests, 26 July 1936, K. M. Liou 6178 (PE); near Anchiapu, 1,800 m, meadows, 23 July 1936, K. M. Liou 5970 (PE); Dongxia, *Picea* forests 21 Aug. 1976, Yu, Lu, Gu & Li 68 (PE); Mt Laoye, 22 June 1962, Liang, Fan, Li et al. 378 (HNWP); *loc. eodem*, 4 Aug. 1977, K. C. Kuan 77309 (PE); *loc. eodem*, 2,300 m, forests, 26 June 1965, Guo & Wang 6008 (HNWP); *loc. eodem*, 2,540 m, 28 June 1989, Zhang & Li 0502 (HNWP); *loc. eodem*, 2,430 m, 19 July 1989, Z. H. Zhang et al. 0097 (HNWP) and 0414 (HNWP); Baoku, 2,600–2,800 m, meadows with shrubs, 27 July 1989, Z. H. Zhang et al. 4291

(HNWP) and 9 Aug. 1989, Z. H. Zhang *et al.* 4317 and 4320 (HNWP). **Golog**: Markog Forest Farm, Hongjungou, 27 July 1983, W. Y. Wang 26818 (HNWP); *loc. eodem*, Wusang Nursery, 27 July 1983, W. Y. Wang 26771 (HNWP); *loc. eodem*, Kopei Nursery, 1 Aug. 1983, W. Y. Wang 27060 (HNWP); *loc. eodem*, Baozanggou, 3,300–3,650 m, 4 Aug. 1983, W. Y. Wang *et al.* 27347 (HNWP). **Huangyuan**, Mt Banjie, bushes, 10 July 1958, P. C. Tsoong 8842 (PE). **Huangzhong**: Sanhei Forest Farm, 2,800 m, 7 Aug. 1973, S. X. Wang 1065 (HNWP); *loc. eodem*, forests and bushes, 20 Aug. 1972, S. W. Liu 2115 (HNWP); 40 km W of Xining, S. X. Zhen 0351 (PE). **Huzhu**: Beishan Forest Farm, 10 June 1971, Guo & He 9012 (HNWP); *loc. eodem*, 1973, Wang & Zhou 198A (HNWP); *loc. eodem*, 14 July 1973, Wang & Zhou 19 (HNWP); Qiaotou, in forests, 2,600 m, 24 Aug. 1965, Guo & Wang 6717 (HNWP). **Jainca**, near Angla, 2,900 m, in forests, 5 June 1970, Liu & Luo 1040 (HNWP). **Ledu**, Maying Township, Kongjiazui, shady forests, 2,500 m, 29 May 1966, B. Z. Guo 6767 (HNWP). **Menyuan**: Semnyi, between Lihua and Dalong, rocky bushes, 3,000 m, 26 June 1962, Z. Y. Qing 1218 (HNWP, PE); Semnyi, Zhugusi, Xielong, 2,600 m, 26 July 1970, B. Z. Guo 7396 (HNWP); Semnyi, Hankegou, 2,600 m, 14 June 1960, Gansu-Qinghai Exped. 2493 (PE). **Minhe**: Gushan, Nanxia, 2,500 m, 10 July 1973, L. H. Zhou 2528 (HNWP); Xin'erbeishan, 2,500 m, 10 July 1970, bushes, B. Z. Guo 7010 (HNWP). **Tongren**: Rongwo, 2,600 m, 2 June 1972, B. Z. Guo 10232 (HNWP); Shuangfengxi, 2,600 m, in forests, 31 May 1972, B. Z. Guo 10186 (HNWP). **Xining (Sining)**, Shangwuchuang, 2,900 m, 3 Aug. 1930, K. S. Hao 779 (PE). **Xunhua**: Mengda Forest Farm, 2,700 m, 5 June 1981, Guo & Wang 25058 (HNWP); Mengda, 23 Sep. 1971, Guo & Yang 9608 (HNWP); Mt Dalijia, bushes by rivers, 3,000 m, 8 Aug. 1973, G. Z. Zhang 005 (HNWP). **SHAANXI, Chang'an**, Zi Wu, Weiziping, 2,700 m, 8 June 1960, Northwest Univ. 68 (PE). **Huxian**: Taipingyu, Hualingwan, 1,900 m, 7 June 1959, *Materia Medica Exped.* 2019 (PE); Gaokuanyu, Xinjialing, 1,900 m, June 1959, *Materia Medica Exped.* 2015 (PB). **Huayin**, Qinglongbei, 29 May 1938, W. Y. Hsia 4539 (PE). **Mt Taibai**: near Dadian Temple, Sep. 1936, W. Y. Hsia 4571 (PE); Sanchaixia, forests by road, 9 June 1952, K. J. Fu 4441 (PE); on the way from Dadian Temple to Dumugong Temple, 2,400–2,650 m, sandstones, 24 May 1985, D. Y. Hong & X. Y. Zhu PB85065 (PE); *loc. eodem*, 2,300–2,700 m, 15 June 1999, Zhu, Chen, Xu & Wang 1321 (PE); Houzhingzi, S slope of Mt Taibai, 2,800 m, 10 Sep. 1999, Zhu, Chen, Xu & Wang 1991 (PE). **SHANXI: s. loc.**, 3 June 1929, T. Tang 938 (PE); *s. loc.*, 12 June 1929, P. Licent 2022 (PE). **Shiziping**, Xigou, 2,350 m, 27 June 1956, Shanxi Exped. Wang & Tian 594 (PE). **Mt Wutai**, Xitai, Xiachantan Village, Xiejiagou, 26 Aug. 1953, Shanxi Exped. 684 (PE). **SICHUAN, Baiyu**, Ronggai, 3,200 m, 4 Sep. 1983, G. T. Peng 21139 (PE). **Baoxing: s. loc.**, 1954, Z. P. Song 38544 (PE) and 39107 (PE); Raozhi, Nibagou, secondary meadows, 3,100 m, 18 May 1982, D. Y. Hong & Z. H. Zhong PB82105 (PE); Longdong Distr., Zhonggan, Mt Daping, 2,700 m, forests, 29 Apr. 1959, Sichuan Econom. Exped. A59-0246 (PE); Ganyanggou, 3,200 m, open places, T. T. Yü 2200 (PE); Dengchigou, 3,400 m, grassy slopes, 29 June 1933, T. H. Tu 4329 (PE); Lianghekou, Mahuangpo, 3,400 m, forests, 18 June 1958, Zhang & Ren 5572 (PE). **Barkam**: near Puyajiao, 2,800 m, 15 May 1957, X. Li 71029 (PE); *loc. eodem*, 205 Lumbering Ground, 2,810 m, 10 May 1957, X. Li 70510 (PE); near Kanzhugou, by rivers, 2,800 m, 5 May 1957, X. Li 70441 (PE); Pu'ermagou, 209 Lumbering Ground, forests, 3,160 m, 26 May 1957, X. Li 70867 (PE); Pu'ermagou, 2,550 m, 30 May 1957, X. Li 70903 (PE); near Matan, 3,200 m, 21 June 1957, X. Li 71645 (PE); Suomo Township, 2,900 m, W slope, sparse forests, petals white, 12 May 2006, D. Y. Hong & Z. Q. Zhou H06007 (PE); Suomo Township, Pingqiaogou, 2,800 m, sparse forests, petals white to pink, 14 May 2006, D. Y. Hong & Z. Q. Zhou H06011 (PE); Barkam Town, Adi Village, 2,700 m, edges of *Betula*–*Picea* forests, 13 May 2006, D. Y. Hong & Z. Q. Zhou H06009 (PE); Dalongjiaogou, 2,650 m, 29 May 1957, X. Li 70685 (PE); near Kafaiqiao, 2,640 m, 28 May 1957, X. Li 71196 (PE); opposite Barkam Town, 2,700 m, 23 Apr. 1957, X. Li 70247 (PE); *loc. eodem*, limestones 2,730 m, 14 May 1985, D. Y. Hong & X. Y. Zhu PB85040 (PE); Zonggag, 2,610 m, 19 May 1957, X. Li 70719 (PE); Nazhugou, 2,920 m, 20 May 1957, X. Li 71087 (PE). **Dawu**, the mountain near Dawu Town, 3,000 m, 7 Aug. 1964, T. L. Dai *et al.* Dawu 64-3 (SM). **Dêgê, s. loc.**,

7 Sep. 1951, S. X. Jia 229 (PE). **Emei**, Jieyindian, 2,740 m, 20 June 1935, T. H. Tu 362 (PE). **Garzê**: S bank of Yalongjiang River, 12 July 1951, Y. W. Cui 4348 (PE); *s. loc.*, on slopes, 8 Sep. 1951, W. G. Hu 13050 (PE). **Heishui**: Shidiaolou Township, 2,900 m, alpine meadows with bushes, 27 May 1959, *Sichuan Econom. Exped.* A59-1208 (PE); Sandougou, 3,000 m, pine forests, 6 May 1959, *Sichuan Econom. Exped.* A59-1001 (PE). **Jinchuan**: Zosijia, 3,600 m, *Picea* forests, 1 Aug. 1958, P. X. Li 10137 (PE); *loc. eodem*, 3,600 m, meadows, 10 Aug. 1958, P. X. Li 10143 (PE); *loc. eodem*, 2,600 m, *Betula* forests, 23 May 1961, S. Jiang 8874 (PE). **Jiulong**, Mt Baitai, between Niupo and Baitai Village, 3,870 m, dense forests, 7 June 1960, J. S. Ying 3869 (PE). **Kangding**: Yulingong, Yingbapo, 17 July 1951, Hu & He 10463 (PE); near Yulingong, 7 Sep. 1951, Hu & He 11173 (PE); *loc. eodem*, 3,200 m, forests, 25 July 1953, X. C. Jiang 36433 (PE); Yulin Township, Simaqiao, 3,100 m, 20 May 1953, Jiang & Xiong 35625 (PE); Laoyulin, 3,150 m, forests, 16 June 1953, X. C. Jiang 36014 (PE); Taiyangshan Distr., 17 July 1951, Hu & He 10373 (PE); *s. loc.*, 13 July 1930, Huang, Luo & Jiang 730 (PE); Niugu Village, 3,360 m, 23 July 1963, Kuan, Wang *et al.* 243 (PE); Xinduqiao, 3,500 m, meadows, 19 July 1963, Kuan, Wang *et al.* 732 (PE); Shade Distr., Mi'Along, 3,200 m, meadows, 23 May 1961, Nanshui-Beidiao *Exped.* 02912 (PE); Zhonggu Village, Dagaigou, meadows, 25 July 1963, Kuan, Wang *et al.* 352 (PE); between Kangding and Dawu, 3,000 m, glades, 9 July 1952, P. C. Tsoong 5004 (PE). **Lixian**: Longxi, Yiduo Village, 10 May 1952, Z. He 12339 (PE); Miyaluo, Misugou, 1 June 1961, S. Jiang A-7162 (PE); Miyaluo, NW slope, 2,600 m, sparse deciduous forest, 12 May 2006, D. Y. Hong & Z. Q. Zhou H06006 (PE); Miyaluo to Mt Zhegu, 3,100 m, edges of *Picea*–*Betula* forests, 19 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95034 (A, CAS, K, MO, PE, US); Shuanjingsi, 3,200 m, edges of forests, 1 June 1958, P. X. Li 10100 (PE); 333 km milestone of Chengdu–Aba highway, 3,250 m, 13 Aug. 1957, Zhang & Zhou 23742 (PE); Somang, 42 km milestone of Shuanjingsi–Barkam highway, 2,900 m, 8 July 1957, Zhang & Zhou 22675 (PE); Laokangmao, 3,300 m, 2 Oct. 1957, X. Li 74936 (PE); Gufenchang, right valley, 3,450 m, 6 Sep. 1957, X. Li 74842 (PE); Donggou, 3,350 m, 13 June 1957, Zhang & Zhou 22092 (PE); the slope opposite the town, 3,400 m, 16 June 1957, Zhang & Zhou 22155 (PE). **Luhuo**: *s. loc.*, 10 July 1952, P. C. Tsoong 5024 (PE); Zhehor, by river, 3,400 m, 10 Aug. 1960, J. S. Ying 4582 (PE) and 4591 (PE). **Mabian**, 3,500 m, meadows or open woods, 26 May 1931, F. T. Wang 22930 (PE). **Maowen**: Mt Mafang, 3,100 m, forests, 15 June 1959, *Sichuan Econom. Exped.* A59-2554 (PE); Xiang-Naha, Sanlonggou, 17 July 1952, He & Zhou 13338 (PE). **Mianning**: Yejin Township, 2,800 m, pastures by rivers, 27 Sep. 1959, S. F. Zhu 20491 (PE); Huning Distr., Jiexingou, 3,000 m, 17 May 1960, S. Jiang 5768 (PE). **Muli**: Wa-chin, 3,300 m, forests, 12 June 1937, T. T. Yü 6137 (PE). **Qianning**: S of the town, 3,450 m, stony grassy slopes, 20 July 1959, Jiang & Jin 2113 (PE); on way to Dawu, 3,700 m, 27 June 1965, Zhang & Lang 57 (PE); Zhonggo, 3,400 m, 19 July 1964, T. L. Dai, R. H. Li & G. H. Tang 64-14 (SM). **Sêrtar**, 1 km S of Wungda, 3,600 m, 22 June 1961, S. Jiang 9082 (PE). **Songpan**, *s. loc.*, 25 Aug. 1928, W. P. Fang 6037 (PE) and 17 Aug. 1928, W. P. Fang 4213 (PE). Sanlian Township to Shibazi, 2,975 m, 18 June 2006, M. Yazbek & Y. Wang WY06049-SPP (PE); Housigou, 28 June 1961, S. Jiang A-7275 (PE); Mont. Occid. 3,500 m, 9 July 1922, H. Smith 2499 (PE). **Tianquan**: *s. loc.*, 14 June 1936, Z. X. Qu 2792 (PE); Mt Erlong, Xiaoniujingou, around Xiashan, 23 June 1951, Hu & He 10088 (PE); Maluqiao, Daletanshan 3,550 m, summit meadows, 27 May 1953, Jiang & Xiong 34242 (PE); Maluqiao, Douniuzi, 2,700 m, forests by rocks, 6 June 1953, Jiang & Xiong 34319 (PE); *loc. eodem*, 2,500 m, 10 June 1959, *Sichuan Econom. Exped.* Ya-838 (PE). **Wenchuan**: Wolong Township, 2,000 m, grasses by river, 22 May 1959, *Sichuan Econom. Exped.* (59) 2290 (PE); Wolong Nature Reserve, Mt Balang, 3,270 m, sparse coniferous forests, 8 May 1985, D. Y. Hong & X. Y. Zhu PB85019 (PE). **Xiaojin**: Xihekou, Niuchanggou, 3,400 m, forests, 26 July 1958, Zhang & Ren 6322 (PE); Luobigou, Yangpingkou, 3,500 m, 23 July 1958, Zhang & Ren 6082 (PE). **Yajiang**: Mt Ermin, 3,500 m, on edges of or in coniferous forests, 22 May 1972, *Sichuan Pl. Coll.* 0905 (PE); Tanjiao to Malangcuo, 3,200 m, 22 Apr. 1960, J. S. Ying 3113 (PE); Mt Gao'er, W slopes, 3,650 m, limestones, clearings of *Picea* forests, sparse *Rhododendron* bushes, 25 Aug. 1995, D. Y. Hong, Y. B. Luo & Y. H. He H95075 (A, K, MO, PE, US). **Yanyuan**, Yantan,

3,380 m, 10 June 1964, T. L. Dai, R. H. Li & G. H. Tang 64-8 (SM). **Zamtang:** Lukesi Temple, right bank, 3,200 m, 28 May 1961, S. Jiang 8930 (PE); 10 km W of Gangmuda, 3,500 m, 1 June 1961, S. Jiang 8965 (PE); Gangqiuda, 3,200 m, 3 July 1979, s. coll. 649 (SM). **XIZANG [TIBET], Jomda,** Gamtog Distr., sunny slopes, 3,100 m, 27 Aug. 1976, Qinghai-Xizang Exped. Vegetation Group 9893 (PE). **YUNNAN, Qiaojia,** Yaoshan, Mt Yaoshan, 3,200 m, limestones, in bushes, 26 May 2004, D. Y. Hong, K. Y. Pan & H. Yu H04032 (PE).

IIIb. *PAEONIA* sect. *PAEONIA* subsect. *FOLIOLATAE* Stern (species 15–25)

- 15. *Paeonia obovata*** Maxim., *Prim. Fl. amur.*, 29 (1859); Huth, *Bot. Jahrb. Syst.* 14(3): 266 (1891); Stern, *Study Gen. Paeonia*, 74 (1946); Anonymous, *Icon. Cormophyt. Sin.* 1: 653, fig. 1305 (1972); Pan, *Fl. Reip. Pop. Sin.* 27: 48 (1979); Hong, Pan & Rao, *Pl. Syst. Evol.* 227: 132 (2001); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 130 (2001). TYPE: Russia, Amur, Kitsi, 11 June 1856, C. J. Maximowicz s.n. (lectotype here designated, LE!; isolectotype K!).
- Paeonia japonica* (Makino) Miyabe & Takeda, *Gard. Chron.* n. ser. 48: 366, fig. 153 (1910); Page & Sinnott, *Bot. Mag.* 18(2): 79 (2001). Basionym: *Paeonia obovata* Maxim. var. *japonica* Makino, *Bot. Mag. (Tokyo)* 12: 302 (1898). *Paeonia obovata* Maxim. subsp. *japonica* (Makino) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 30 (1997); Halda, *Gen. Paeonia*, 110 (2004). TYPE: Fig. 153 in Miyabe & Takeda, 1910: 366 (neotype here designated).
- Paeonia japonica* (Makino) Miyabe & Takeda var. *pilosa* Nakai, *J. Jap. Bot.* 13: 395 (1937). TYPE: Korea, Heinan, Mt Rorinsan, 14 June 1936, Tei s.n. (holotype TI!).
- Paeonia oreogeton* S. Moore, *J. Linn. Soc. Bot.* 17: 376 (1879); Kitagawa, *Neo-Lin. fl. manshur.*, 303 (1979). *Paeonia obovata* Maxim. f. *oreogeton* (S. Moore) Kitag., *Lin. fl. manshur.*, 221 (1939). TYPE: China, “Prov. Shinking” [Liaoning], “Kwandien (Kuandian), Shag mtn? 29.4.76”, 29 Apr. 1876, sine coll. 97 [Com. Mr John Ross 10/77] (lectotype designated by Hong *et al.* 2001c, K!).
- Paeonia vernalis* Mandl, *Bot. Közlemenyek* 19: 90 (1921). TYPE: Russia, The Far East, Nikolsk-Ussurisk, in conifer forests, 10 Aug. 1913, A. I. Fritz s.n. (lectotype here designated, LE!).

Herbs perennial, 30–70 cm tall. Roots thick, carrot-shaped, attenuate toward tip. Caudex usually short, 2–8 cm long. Stems glabrous, with 5–8 pink or yellow-green scales at the base. Lower leaves spreading or ascending, biternate; leaflets 9 in number, entire, very occasionally one of them 2-segmented, obovate, cuneate at the base, rounded or acute at the apex, 5–20 cm long, 4–14 cm wide, glabrous above, glabrous to densely hispid beneath. Flowers solitary, terminal; involucre bracts 1 or 2 in number, unequal in size, leaf-like, rarely lacking; sepals 2–4, but mostly 3 in number, unequal in size, 1.5–3 cm long, 1.5–2 cm wide, mostly rounded at the apex; petals 4–7 in number, spreading or incurved, white, rose, pink-red, red, purple-red, or rarely white with pinkish base or margins, obovate, 3–5.5 cm long, 1.8–2.8 cm wide; filaments white, whitish-yellow, or purple below but white above to entirely purple; anthers yellow, orange-red or dark purple; disk yellow, waved, 1–1.5 mm high; carpels mostly 2 or 3, rarely 1, 4 or 5 in number, always glabrous; ovary green; styles 2–5 mm long; stigmas red, 2–3 mm wide. Follicles gradually recurved, ellipsoid, 2–3 cm long. Seeds black, glossy, ovoid-spherical, 6–7 mm long, 5–6 mm in diameter. Figs 5.15A, 5.15B.

PHENOLOGY. Flowering in May and June; fruiting from July to September.

CHROMOSOME NUMBER. $2n = 10, 20$ (Hong *et al.*, 2001c).

HABITATS. In deciduous broad-leaved or mixed broad-leaved and conifer forests, at altitudes from lowlands to 2,800 m.

DISTRIBUTION. Widely distributed in E Asia: China (NE, E and central), Japan, the Korea Peninsula and the Far East of Russia (Map 5.15).

NOTES. Hong and coworkers (Hong *et al.*, 2001c) have explained clearly why *Paeonia japonica* and the other taxa were treated in synonymy. Makino (1898: 302) did not designate type for his new variety, var. *japonica*, so we designated Miyabe and Takeda's figure as neotype. Mandl (1921) did not designate type for his new species. A. I. Fritz's collection matches the protologue very well and the locality is the same as indicated in the protologue. Thus, it might be the specimen, based on which the new species was described.

Paeonia obovata comprises two geographically allopatric subspecies that are keyed out below:

- 1a. Leaves mostly glabrous or sparsely (occasionally densely) hispid on lower surface; diploid (tetraploids rarely occurring in the Far East of Russia and on Mt Changbai of NE China) 15a. subsp. *obovata*
- 1b. Leaves usually densely, very occasionally sparsely, hispid on lower surface; tetraploid (the only diploid found in a mixed population in Lushi County, W Henan) 15b. subsp. *willmottiae*

15a. *Paeonia obovata* subsp. *obovata*

Paeonia japonica (Makino) Miyabe & Takeda var. *typica* Nakai in *J. Jap. Bot.* 13: 394 (1937). TYPE: Japan, Prov. Musasi, Mt Takaosan, 24 Aug. 1879. R. Yatabe s.n. (lectotype here designated: TI).

Paeonia obovata Maxim. var. *typica* Makino, *Bot. Mag. (Tokyo)* 12: 302 (1898); Makino, *J. Jap. Bot.* 5(9): 33 (1928). TYPE: not designated.

Paeonia obovata Maxim. var. *amurensis* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 44 (1921). TYPE: not designated.

Paeonia obovata Maxim. var. *australis* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 44 (1921). TYPE: not designated.

Paeonia obovata Maxim. var. *glabra* Makino, *J. Jap. Bot.* 5(9): 33 (1928). TYPE: not designated.

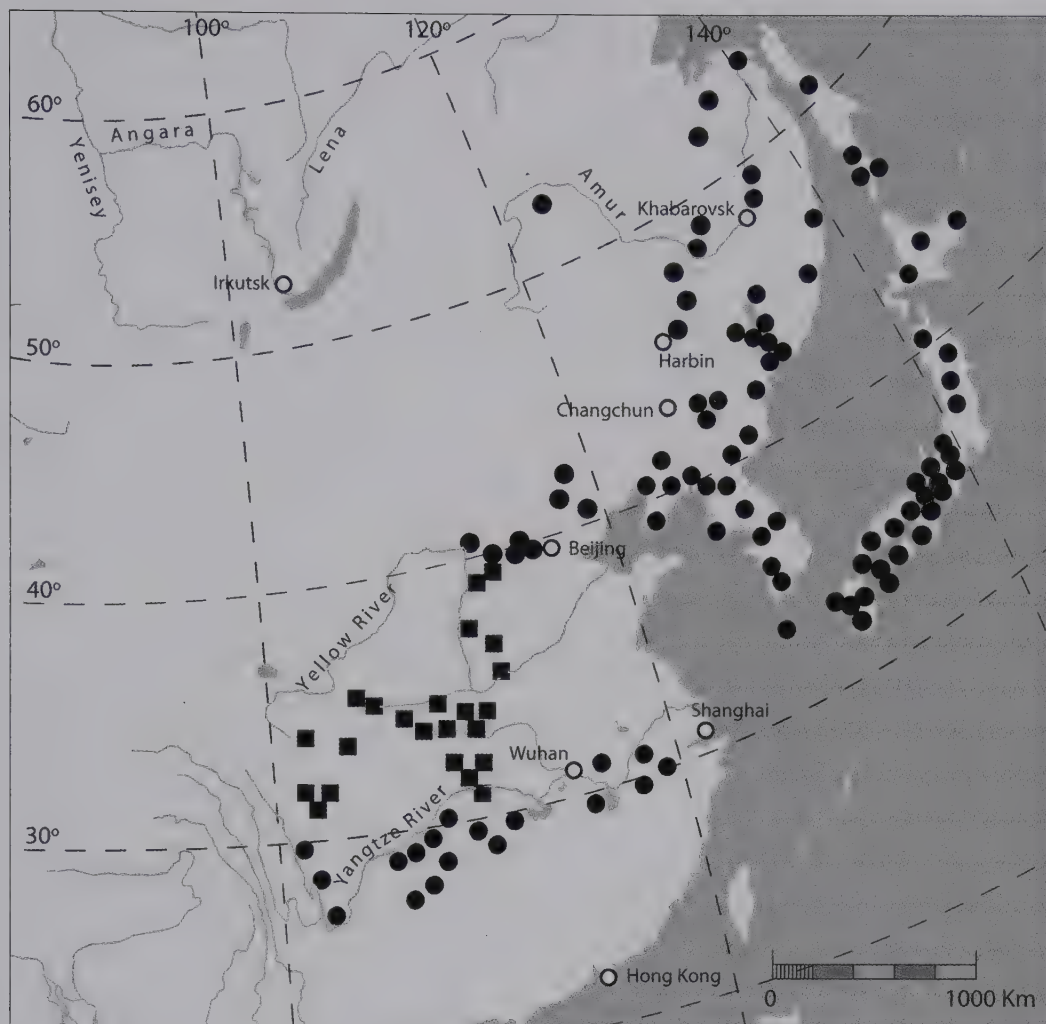
Paeonia obovata Maxim. var. *alba* Saunders, *Nat. Hort. Mag.* 13: 227, cum tab. (1934). TYPE: Tab. s.n. in Saunders, 1934 (holotype!).

PHENOLOGY. Flowering from late April to early June; fruiting from late July to August.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, 2001c) and $2n = 20$ (Hong *et al.*, 2001c).

HABITAT AND DISTRIBUTION. Growing in deciduous broad-leaved, mixed broad-leaved and needle-leaved, or coniferous forests, on various media, shales, granites, basalts, etc. and at altitudes from lowlands to 2,800 m. Distributed in Japan, the Korea Peninsula, the Far East of Russia and NE, N and E China, in addition to a small area in SW China (Map 5.15).

ADDITIONAL SPECIMENS EXAMINED. **CHINA, ANHUI, Mt Huangshan**, road to E of Tungwopong, 5 July 1936, P. C. Tsoong 4090 (PE). **Mt Jiuhua**: Tiantai Peak, 18 Oct. 1951, Huadong Station 6051 (PE); Shangmingyuan, Apr. 1986, D. Y. Hong & T. Chen PB86003 (PE) and PB86006 (PE). **Yuexi**: Yaoluoping, J. Z. Qiu PB88402 (PE) and PB88403 (PE); *loc. eodem*, Z. W. Xie H98035 (A, CAS, K, MO, PE, US). **BEIJING**: Baihuashan, 1933, C. W. Wang 60273 (PE); *loc. eodem*, 2,000 m, 23 June 1936, D. F. Jin 038 (PE). **Miyun**: W slope of Wulingshan, 1,400 m, *Larix-Pinus-Betula* forests, 31 May 1998, D. Y. Hong & G. Y. Rao H98033 (A, CAS, MO, PE, US); *loc. eodem*, 4 Sep. 1996, D. Y. Hong, K. Y. Ding & L. Z. Gao H96172 (PE); *loc. eodem*, 16 Sep. 1951, W. T. Wang 2531 (PE); *loc. eodem*, 27 Sep. 1951, W. T. Wang 2699 (PE). **CHONGQING: Nanchuan**: Mt Jinfoshan, Yangyuping, Lijiadian, 1,300 m, 14 May 1957, K. F. Li 61119 (PE, SZ); Mt Jinfoshan, Lianhuashi Temple, 2,000 m, June 1935, K. L. Chü 1621 (PE); Mt Jinfoshan, 1,830–2,130 m, W. P. Fang 1081 (PE, SZ); Mt Jinfoshan, Tiechangping, Z. Y. Liu H98038 (A, CAS, K, MO, PE, US); Mt Jinfoshan, Delong, Guandaoya, X. Y. Zhu & S. Y. Song PB86051 (PE); *loc. eodem*, X. Y. Zhu *et al.* PB86020 (PE) and PB86021 (PE); Mt Jinfoshan, Mazui, Chuanbiya, Z. Y. Liu *et al.* PB86027 (PE); *loc. eodem*, X. Y. Zhu *et al.* PB86019 (PE); Mt Jinfoshan, Liangjiawan, X. Y. Zhu & S. Y. Song



Map 5.15. Distribution of *Paeonia obovata* Maxim.: black circles = subsp. *obovata*; squares = subsp. *willmottiae*.

PB86035 (PE); Delong, on the way to Shimaoliang, X. Y. Zhu & S. Y. Song PB86023 (PE) and PB86028 (PE). **Pengshui**, Datong, Shenxianbao, in forests, 1,200 m, 21 June 1974, *s. coll.* 662 (SM). **Qianjiang**, Mt Bamian, 1,700 m, 1 Aug. 1979, *s. coll.* 886 (SM). **Shizhu**: Mawu, 700 m, 27 Apr. 1979, *s. coll.* 0331 (SM); Lixin, Huashuba, 1,470 m, 22 May 1959, *Sichuan Econom. Plants Exped.-Fuling Team* (X. Zhang) 522 (SM). **GUIZHOU, Zunyi City**, Xianrenshan, 1,860 m, in forests, 10 Apr. 1959, *Qianbei Exped.* 0115 (HGAS, PE). **Dafang**, Bainan, Mt Jiulong, 2000 m, 18 Aug. 1959, *Bijie Exped.* 984 (HGAS, K, PE). **HEBEI, Chengde**: Wenchanggou, 800 m, 1 Sep. 1953, X. Y. Liu 1665 (PE); Xianrentagou, 21 July 1956, *Herbarium Team* 2130 (PE). **Chicheng**: Mt Dahaituo, June 1985, D. Y. Hong, Y. Chen & S. Y. Song PB85078 (PE); *loc. eodem*, 1,280 m, 8 Sep. 1959, *s. coll.* 6544 (PE); *loc. eodem*, 1,400 m, 9 Sep. 1959, *s. coll.* 6549 (PE); Laoshanzi, 1,800 m, 12 Sep. 1959, *s. coll.* 0543 (PE); Donglingshan, Aug. 1930, H. T. Tsai 50441 (PE); *loc. eodem*, 6 May 1935, Y. Liu 10266 (PE); *loc. eodem*, 1,600 m, June 1931, T. Tang 2074 (PE); near Dongling, 19 July 1930, T. N. Liou 1411 (PE); *loc. eodem*, 1,360 m, 22 June 1931, K. M. Liou 394 (PE); Shidaozihe, *Dongling Exped.* 269 (PE); Sungshuwa, 1,350 m, 23 July 1930, H. F. Chow 40669 (PE); Yangjiaping, in forests, 18 Aug. 1933, C. W. Wang 60905 (PE); *loc. eodem*, 1,800 m, 1934, C. W.



Wang 61885 (PE). **Fuping**, Longquankuan, Liaodaobai, *Fuping Exped.* 3 (PE). **Huailai**, Tangying Temple Hot Spring, 5 July 1959, *s. coll.* 2117 (PE). **Laishui**, Siqu, 8 June 1952, C. G. Yang 888 (PE). **Neiqiu**: Duanmutao, 16 June 1951, X. Y. Liu 433 (PE); Nanyao, Shuipingdiyao, 20 June 1951, X. Y. Liu 483 (PE). **Pingshan**, Xiakou, *s. coll.* 116 (PE); Muchang, Tongdonggou, *s. coll.* 466 (PE). **Qianxi**, Xishuiling, *Qianxi Exped.* 205 (PE). **Qinlong**, Wudaoling, *Qinlong Exped.* 972 (PE). **Weichang**, *loc. eodem*, *Chengde Exped.* 35 (PE); Huangtuk, Toudaochuan, *Huang* 489 (PE). **Wu'an**, Neihuilian, 4 July 1958, K. C. Kuan 5843 (PE). **Xiaowutai**: in forests, 11 June 1930, H. W. Kung 336 (PE); *loc. eodem*, Aug. 1935, Y. Liu 11344 (PE); Xitai, 16 June 1959, *s. coll.* 451 (PE); Zhongtai, 17 July 1959, *s. coll.* 1967 (PE); Yanjiagou, 18 July 1959, *s. coll.* 2339 (PE); Beitai, 16 July 1930, P. Licent, P. 2622 (PE); Tangying Temple, in forests, 28 Sep. 1956, *Herbarium Team* 2622 (PE); Dong'an Temple, Changqianggou, *s. coll.* 2572 (PE). **Xinglong**: Mt Wuling, Lianhuachi, T. N. Liou 4740 (IFP); *loc. eodem*, Z. F. Fang s.n. (IFP); Wuling, 1,460 m, 9 June 1931, K. M. Liou 217 (PE). **Yanqing**, Hongqidian, Shuitoucun, Xigou, *s. coll.* 869 (PE). **Yixian**, Dayukou, *s. coll.* 3348 (PE); Kuanzuoling, 760 m, 20 May 1934, K. M. Liou 2004 (PE). **Yuxian**, Nanliangqing, *Zhangjiakou Exped.* 11 (PE). **Zanhuang**, Loudi, Zhangshiyan, *Shijiazuo Exped.* 531 (PE). **Zhuhua**, Eastern Tombs, T. N. Liou 1411 (PE); *loc. eodem*, K. M. Liou s.n. (PE). **HEILONGJIANG, Dailing**, Lianshuigou, pine forests, 16 July 1956, *Sino-German Exped.* 7476 (PE). **Hailin**, Hengdaohezi, 28 Sep. 1950, X. Y. Hou 11759 (PE). **Hulin**, Hutoujian, 29 Aug. 1952, G. Z. WANG 408 (IFP, PE). **Mohe**, Tuqiang, Wusuli, 53°30'N, 123°05'E, 28 Aug. 2001, Cao & Cheng H01033 (A, BM, CAS, K, MO, PE). **Mudanjiang**, 1959, *Wild Plants Exped. Mudanjiang Team* 0621 (PE). **Ning'an**, Jiangshuijiao Forest Farm, Daqinggou *s. coll.* s.n. (IFP). **Shangzi**: Weihe Distr. Datutouzi, *s. coll.* s.n. (IFP); Mao'er Shan, *s. coll.* s.n. (PE). **Upper Ussuri**, Maximowicz, *Iter sec. anno* 1860 (K, PE). **Yichun**, near Wuying, pine forest clearings, 4 Aug. 1956, *Sino-German Exped.* 7903 (PE). **HENAN, Huixian**, Guanshan, Shuangjing, 1,600 m, forests, 6 May 2007, D. Y. Hong & K. Y. Pan H07002 (PE). **Shangcheng**: Gangtai, Mao'ershi, 1,125 m, 18 Apr. 1959, *s. coll.* 312 (PE); Jingantai, May 1988, J. Z. Qiu PB88501 (PE). **HUBEI, Lichuan**, Y. Q. Ye 145 (PE), 248 (PE) and 511 (PE). **Hefeng**: Zouma Township, Guchengping, 29 Apr. 1959, P. S. Peng H93 (PE); Yanziping, 23 Apr. 1959, P. S. Peng 170 (PE). **HUNAN, Sangzhi**: *s. loc.*, 1,500 m, in forest, 4 July 1988, *Beijing Team* 2378 (PE); Shadiping, Baheshe, 1,200 m, 8 July 1958, L. H. Liu 9344 (PE); Bamaoxi, Xiaozhuangping, 1,700 m, 5 July 1975, S. P. Wan 750150 (PE). **Shimen**, Xiaoxi, Hongtong Gou, 1,500–1,600 m, 10 July 1987, *Hupingshan Exped.* 1317 (PE). **JIANGXI: Mt Lushan**, Huanglong'en, 9 Sep. 1951, M. J. Wang 285 (PE). **JILIN, Antu**: Mt Changbai, 1,500 m, sparse woods, 3 Aug. 1957, *Northeast Normal Univ.* 664 (PE); *loc. eodem*, 1,500 m, coniferous forests, 27 May 1998, D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao H98026 (A, CAS, K, MO, PE, US); *loc. eodem*, 1,600–1,700 m, 13 Aug. 1959, *Yanbian First Team* 269 (PE); *loc. eodem*, Naitou Shan, 1,000 m, deciduous forests, 26 May 1998, D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao H98025 (A, MO, PE); *loc. eodem*, Z. A. Chen 99 (IFP); *loc. eodem*, Jingyingsuo, P. Y. Fu et al. 1267 (PE); Naitou Shan to Laolangbao, 800 m, deciduous forests, 2 Sep. 1951, T. N. Liou 3906 (PE); Erdaobaihe to Naitou Shan, C. Q. Lin 1455 (IFP); Songshui Township, Nanshili, mixed forests, 23 Aug. 1959, *Yanbian Second Team* 199 (PE); Toudaobaihe to Xiaoping Shan, C. Q. Lin 1377 (IFP); Hualazi, 800 m, mixed forests, 18 Aug. 1959, *Yanbian Second Team* 104 (PE); Hepingyingzi, *Normal Univ. Exped.* 826 (PE). **Fusong**: Mt Changbai, Manjiang, Gudingzi, 1,000 m, 11 June 1962, *Temperate Forest Exped.* 075 (PE); *loc. eodem*, Aug. 1986, D. Y. Hong PB86071 (PE), PB86073 (PE) and PB86074 (PE); *loc. eodem*,

Fig. 5.15A (opposite). *Paeonia obovata* Maxim.: **a–e**, subsp. *obovata*. **a**, the lower part of the plant showing carrot-shaped roots; **b**, the upper part of the plant and a flower with petals and stamens shed, showing disk and glabrous carpels; **c**, a lower leaf; **d**, a follicle; **e**, the lower surface of a leaf, showing sparse hirsute hairs; **f**, subsp. *willmottiae* (Stapf) D. Y. Hong & K. Y. Pan, the lower surface of a leaf, showing dense hirsute hairs. Drawn by Miss LI Ai-Li.

Duezigou to Yuanyangdi, Aug. 1986, D. Y. Hong & J. Z. Qiu PB86072 (PE); *loc. eodem*, Weidong, Longtoushan, Aug. 1986, D. Y. Hong & J. Z. Qiu PB86052 (PE); *loc. eodem*, Fengling Reserve Station, D. Y. Hong & J. Z. Qiu PB86062 (PE); Donggang, Manjiang, Huamahezi, in forests, 17 July 1950, Noda, M. *et al.* 196 (IFP; PE). **Helong**, near Guangping, 6 Sep. 1959, *Yanbian Second Team* 570 (PE). **Hunchun**, Mt Changbai to Erdao Water Power Station, Z. F. Fang 3564 (IFP). **Ji'an**, Renao Forest Farm, Z. F. Fang 2285 (IFP). **Jingyu**, J. Sato 10005 (PE). **Linjiang**, Sanchazi Longwan, 800 m, in forests, 25 June 1950, T. N. Liou 1077 (IFP, PE). **Liuhe**, Yousong, Liao'angou, Sandaolian, Y. C. Deng 798 (IFP). **LIAONING**, *s. loc.*, P. H. Dorsett & J. H. Dorsett 4142 (PE). **Anshan**: Qianshan, Miaotai, Fifth Group Village, 280 m, *Tilia-Quercus* forests, 24 May 1998, D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao H98015 (A, CAS, K, MO, PE, US); Qianshan, near Xinquan Temple, T. N. Liou *et al.* 437 (IFP); Qianshan, near Muyu'en Monastery, 7 Oct. 1955, T. N. Liou 6883 (IFP); Qianshan, 20 May 1928, J. Sato 3055 (IFP, PE); Qianshan, Beigou, in forests, 27 Sep. 1950, Q. S. Li, P. Y. Fu *et al.* 2524 (IFP, PE). **Benxi**: Dongyingfang, C. Q. Lin 1232 (IFP); Caohekou, Y. X. Liu *et al.* 1427 (IFP); *loc. eodem*, L. F. Hang 297 (IFP); 10 km W of Lianshanguan Fort, 650 m, shale, sparse *Larix* forests, 24 May 1998, D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao H98019 (A, CAS, K, MO, PE, US); Caohezhang, Tanggou, Gaolaopodingzi, S. X. Li 651 (IFP); Tanggou, Hujiapuzi, C. S. Wang 4340 (IFP); Caohezhang, C. Q. Lin 993 (IFP). **Dalian**, Laotieshan, Y. C. Lu 3372 (IFP). **Fengcheng**: Yuanyang, Y. L. Zhang 2513 (IFP); Yuanyang Forest Farm, J. Y. Li 823 (IFP); *loc. eodem*, Y. C. Deng 181 (IFP); Fenghuangshan, P. Y. Fu & Y. C. Deng 2866 (IFP); *loc. eodem*, D. C. Zhao *et al.* 323 (IFP); *loc. eodem*, L. F. Hang 218 (IFP); *loc. eodem*, Noda, M. 441 (IFP). **Huanren**, Mumengzi Township, S. C. Cui *et al.* 270 (IFP). **Kuandian**: Baishilazi Nature Reserve, 25 May 1998, D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao H98023 (A, CAS, K, MO, PE, US); Shuangshanzi, J. Y. Li 1190 (IFP) and 6367 (IFP). **Lingyuan**, Dabiengou, the mountain in front of Linjia Dayuan, W. Wang 690 (IFP). **Qingyuan**: Xiaojiabaozi Township, Dadi,

C. S. Wang *et al.* 1239 (IFP); Xiaojiabaozi Township, Xinlitun, 600 m, granites, *Quercus-Fraxinus* forest, 29 May 1998, D. Y. Hong, K. Y. Pan, G. Y. Rao & W. Cao H98031 (A, CAS, K, MO, PE, US). **Xifeng**: Helong, Jiuru, Y. Y. Lin 7 (IFP); Helong, Nanshanlaolin, Taikougou, P. Y. Fu 2948 (IFP). **Xinbing**, Laogangshan, *General Exped.* 210 and 223 (IFP). **Xiuyan**, Tangchi, mixed forests, 10 Sep. 1959, W. Wang *et al.* 1521 (IFP, PE). **Yingkou**, Jianyi Township, Luwangzipu, *Yingkou General Exped.* 168 (IFP). **Zhuanghe**, Buyunshan, Dayang-gou, S. X. Li 151 (IFP). **NEI MONGOL (Inner Mongolia)**, **Daqingshan Mts**: Halaqin, in *Betula* forests, 1,600 m, 16 June 1964, *Inner Mongolia Univ.* 60 (HIMC); Halagou, Huangcaowa, in *Betula* forests, 1,600 m, 30 June 1964, *Inner Mongolia Univ.* 62-2-74 (HIMC). **Xinghe**: *s. loc.* 8 Sep. 1972, Q. R. Wu 260 (HIMC). **Hexigten Qi**, *s. loc.*, in *Betula* forests, 26 July 1960, *Inner Mongolia Univ.* 263 (HIMC). **Ningcheng**: Dayingzi, Bagudao, Erdaogou, S. X. Li

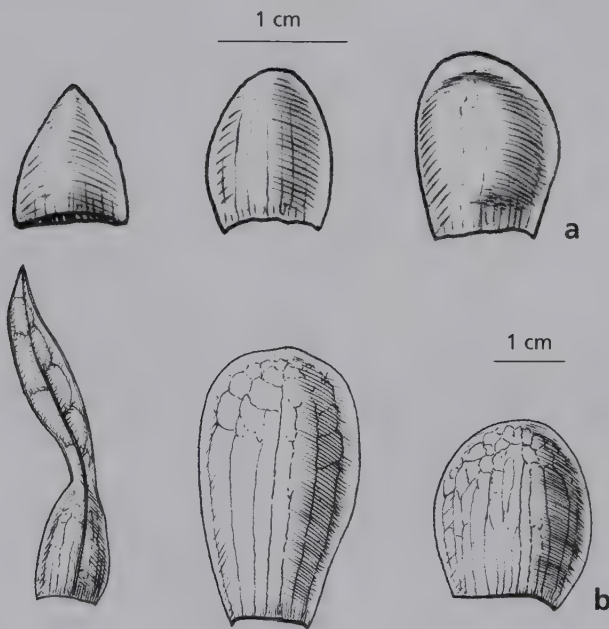


Fig. 5.15B. *Paeonia obovata* Maxim.: involucre bracts and sepals: **a**, subsp. *obovata*, based on Cao & Cheng H01033 (A, BM, CAS, K, MO, PE); **b**, subsp. *willmottiae* (Stapf) D. Y. Hong & K. Y. Pan, based on D. Y. Hong & Z. Q. Zhou H04044 (PE). Drawn by Mr SUN Yin-Bao.

4710 (IFP); Cunjingou, Xiaoliangzi, S. X. Li 4437 (IFP); Sidaogou, 15 July 1985, Y. M. Zhu *et al.* 320 (HIMC). **SICHUAN**, **Huidong**, Duge Township, 2,800 m, in forests, 22 June 1959, S. G. Wu 1153 (SM). **Luding**, Erlongshan, Daba, Hou Shan, W. G. Hu 37902 (PE, SZ). **Xuyong**, Fenshui Distr., Luohanlin Forest Farm, 1,500 m, 28 May 1964, M. F. Zhong & Z. C. Zhao 0527 (SM). **Yuexi**: Mantan, 2,000 m, 7 July 1959, *Chuanjingliang Exped.* (59) 3710 (PE, SZ); Mishan, 2,000 m, 3 July 1959, *Chuanjingliang Exped.* (59) 3597 (PE, SZ); Dongshan, Dashuigou, X. Y. Zhu & S. Y. Song PB86024A (PE); Ge'e, Shipojiayi, X. Y. Zhu & S. Y. Song PB86025 (PE). **ZHEJIANG**, **Anji**, Longwang Shan, L. Chen 086 (ZJFC). **Mt W Tianmu**: Sanmuping, Xiwan, 1,350 m, granites, 8 May 1998, D. Y. Hong, K. Y. Pan & L. H. Lou H98001 (A, CAS, K, MO, PE, US); *loc. eodem*, 8 May 1998, D. Y. Hong, K. Y. Pan & L. H. Lou H98002 (PE); Xianrending, 1,480 m, in forests, 20 May 1957, H. Deng & Y. H. Yuan s.n. (PE); *loc. eodem*, 1,500 m, 2 Sep. 1959, *Zhejiang Plant Resources Exped.* 29524 (PE); *loc. eodem*, M. P. Deng 4009 (PE); Wuliting, 1 May 1929, K. K. Tsoong 284 (PE); Hengtang, in forests, 28 June 1957, X. Y. He 22425 (PE). **Hangzhou**, Mt Jiguan near Xihu Lake, 16 May 1959, Q. H. Li & C. Chen 888 (PE). **JAPAN**: **Aichi**, Toei-cho, K. Torii s.n. (KYO). **Aomori**, Higashitsugaru-gun, Imbetsu-cho, Ookawadai, K. Mimoro *et al.* 3901 (KYO). **Ehime**, Kamiukena-gun, Onogahara, Genjigadaha, G. Murata & T. Shimizu 2576 (KYO); Kamiukena-gun, Oda-cho, Oda-miyama, S. Mitsuta 12681 (KYO); Uma-gun, Doi-cho, from Kawamato to Akaishi-Kozan, M. Hotta 10710 (KYO); *loc. eodem*, Higashiakaishi Mts, Mt Gongendake, M. Hotta 10740 (KYO); Higashi-Uwa-gun, Nomura-cho. Onogahara, from Genjigedaba to Kamatsu, N. Kurosaki 6771 (KYO); Oda, Fukayama, S. Yamashita s.n. (KYO); Uma-gun, Doichou-cho, Mt Akaboshi, D. Y. Hong PB90010 (PE); To-Uwa-gun, Uwa-cho, D. Y. Hong PB90011 (PE). **Fukui**: Nyu-gun, Echizen-cho, Rokuroshi, N. Kurosaki 10731 (KYO); Imatatsu-gun, Ikeda-mura, Hekozan, S. Watanabe s.n. (KYO); Aobayama, Z. Tashiro s.n. (KYO). **Fukushima**, Nishishiragawa-gun, Nishisato-mura, Z. Suzuki s.n. (KYO). **Gifu**, Ibi-gun, Kasuga-mura, from Sasamata to Mt Ibuki, H. Takaheshi & H. Takano 7313 (KYO). **Gumma**, Agatsuma-gun, Tsumagoi-mura, Nidoage, T. Yahara *et al.* 7033 (KYO). **Hiroshima**, Saiki-gun, Mizuda-mura, M. Kato s.n. (KYO). **Hokkaido**: Sapporo, H. Morida s.n. (KYO); Kuriler Islands, J. Ohwi 250 (KYO); Kitanu, Kitanufuji, S. Okamoto s.n. (KYO); Tomakomai, S. Minagi s.n. (KYO); Shiribeshi, Shimamaki-gun, along Tomarikawa River, N. Naruhashi 2565 (KYO); S Hokkaido, W. P. Brooks 551 (KYO). **Hyogo**: Yabu-gun, Yoka-cho, Tsubairo, N. Kurosaki 15145 (KYO); Shiso-gun, Haga-cho, Onzui, G. Murata *et al.* 125 (KYO); Sayou-gun, Mikazuki-cho, Turutani-Takidani, M. Hashimoto 9818 (KYO); Yabu-gun, Sekinomiyachou, M. Hashimoto 10414 (KYO). **Iwate**: Shimohei-gun, Akka-mura, Takasuka, T. Shimizu 01937 (KYO); Morioka-shi, near Hako-gamori, M. Wakabayashi 308 (KYO). **Kagawa**, Kagawa-gun, Shioe-mura, Mt Ohtaki, M. Hiroe 15608 (KYO). **Kanagawa**, Hakone, Nagaotoge, Togasi, M. 1288 (KYO). **Kochi**: Tosa, Tomioka-mura, Otakijinja to Mt Tsutsujosan, G. Murata & T. Shimizu 817 (KYO) and 829 (KYO); Tosa, Yuzuhara-mura, from Tanono to Onogahara, G. Murata & T. Shimizu 2553 (KYO); Tosa, Niyodo-mura, Takaokagun, Mt Kurotakiyama to Mt Tengenomori, G. Murata 17333 (KYO); Kami-gun, Monobe-mura, Mt Ishitate, N. Kurosaki 7417 (KYO); Mt Ishitate, G. Murata & T. Shimizu 2326 (KYO) and 2380 (KYO); Mt Takaeka-gun, Niyodo-mura, Torigata-yama, H. Koyama & G. Murata 4272 (KYO); Takaeka-gun, Yusuhara-cho, Shikoku-karst, from Tengu-ralgo to Oohikiwari-pass, N. Fujita & E. Miki 120 (KYO); Takaoka-gun, Mt Torigata, T. Shimizu 5998 (KYO). **Kumamoto**: Yatsushiro-gun, Tzumi-mura, from Kureko to Mt Iwauda-yama, M. Hotta 12062 (KYO); Kuma-gun, Youra-mura, Mt Nokeeboshi, from Shiiba to Hotokeishi, T. Shimizu 4652 (KYO) and 5018 (KYO); Yatsushiro-gun, Matashidani, Izume, Naruhashi 3063 (KYO). **Kyoto**: Funai-gun, H. Yamamoto 533 (KYO); Higami-gun, Aogakimachi, S. Hosomi 9160 (KYO); Kitakuwada-gun, Kuroda-mura, H. Yamamoto 999 (KYO); Kitakuwada-gun, Keihoku-cho, K. Nagai 24797 (KYO); Tanba, Kitakuwada-gun, Chii-mura, Ashiu, Kitakuwada-gun, G. Murata 7080 (KYO); Tanba, Hiyoshicho, near Ebidami, G. Murata 18036 (KYO); Tanba, Ayabe,

Koyaokatyo, Wasadani, G. *Murata* 11167 (KYO); Yamashiro, Taizizan, G. *Nakai* 2257 (KYO); Mt Kurama, Sakyo-ku, M. *Hiroe* 18046 (KYO); Yamashiro, Hanasetoge, G. *Nakai* 676 (KYO); Yamashiro, Taizizan, Kuwadani, G. *Murata* 9598 (KYO); Yamashiro, Taizizan, *Tashiro* s.n. (KYO). **Mie**, Ichisi-gun, Misagi-mura, G. *Murata* & N. *Fukuoka* 194 (KYO). **Miyagi**, Oshika-gun, Kinkasan-to, T. *Naito* s.n. (KYO). **Miyazaki**: Higashiusuki-gun, Shiba-mura, Mt Shiraiwa, M. *Hotta* 6438 (KYO); *loc. eodem*, M. *Hotta* 10445 (KYO); *loc. eodem*, from Mt Ougiyama to Matuki, M. *Hotta* 10462 (KYO); Higashiusuki-gun, Kitagawa-cho, Okue Mts, from Setoguchidani to Mt Goyodake, T. *Yahara* & M. *Ito* 4917 (KYO). **Nagano**: Shimoina-gun, Oojika-mura, Tsubame-iwa, T. *Shimizu* 5815 (KYO); Kamiina-gun, Hase-mura, from Yoshi-gadaira to Mt Shira-iwa-dake, M. *Wakabayashi* 801 (KYO). **Nara**: Yoshino-gun, Omine Mts, from Kawai to Gyojagaeri, M. *Hotta et al.* 27 (KYO); Yoshino-gun, Tenkawa-mura, Omine Mts, near Goyomatsu-shonyudoh, K. *Ueda* 489 (KYO); Yoshino-gun, Omine Mts, from Mt Misen to Gyojagaeri, T. *Shimizu* 4328 (KYO); Yoshino-gun, Tenkawa-mura, Omine Mts, from Mt Gyojagaeri to Ichinotae, N. *Fukuoka* & M. *Hotta* 215 (KYO); Yoshino-gun, Mt Gyojagaeri, M. *Hotta et al.* 83 (KYO); Yoshino-gun, Tenkawa-mura, from Dorogawa to Hourikitouge, N. *Fukuoka* & M. *Hotta* 56 (KYO); *loc. eodem*, G. *Murata* & K. *Iwatsuki* 7 (KYO); Yoshino-gun, Omine Mts, from Gyojagaeri to Misen, M. *Hotta* & M. *Wakabayashi* 171 (KYO); *loc. eodem*, G. *Murata* & T. *Shimizu* 100 (KYO); *loc. eodem*, G. *Murata* 10759 (KYO); Yoshino-gun, Omine Mts, from Dorogawa to Rengetsuji, M. *Hotta et al.* 22 (KYO). **Niigata**: Sado (island), between Mt Donden and Mt Kongo, M. *Okamoto* 2438 (KYO); Nishi-kubiki-gun, Aomi-cho, Mt Kurohime, M. *Hiroe* 14460 (KYO); Naebazan, S. *Okuyama* s.n. (KYO). **Oita**: N Oita, Yufudake, Z. *Tashiro* s.n. (KYO); Mt Kurodake, Z. *Tashiro* s.n. (KYO); Kujuzan, Hokain, Z. *Tashiro* s.n. (KYO); Yufudake, Z. *Tashiro* s.n. (KYO). **Okayama**, Honkayabe, Kawakami-mura, Mt Maru-yama and Asanabewashiga-sen, S. *Fujii* 164 (KYO). **Saga**, Tachodake, N of Saga city, Z. *Tashiro* s.n. (KYO). **Shiga**: Along the N ridge of Mt Ibuki-yama, N. *Fukuoka* 8061 (KYO); Inukami-gun, Taga-cho, near Ozigahata, G. *Murata* & N. *Fukuoka* 12 (KYO); Sakata-gun, Maibara-cho, Kuregahata, K. *Nagai* s.n. (KYO); Sakata-gun, Maibara-cho, Mt Ryozenyama, from Kaminyu to summit, G. *Murata* 55612 (KYO); Hira Mts, Mt Horai, M. *Hiroe* 13154 (KYO). **Shimane**, Tsuwanomachi, J. *Ohwi* s.n. (KYO). **Shizuoka**: Shizuoka, from Magosajima to Ikawa pass, E. *Miki* 213 (KYO); Haibara-gun, Hon-Kawane-cho, from Mt Fudou to Mt Morosawa, H. *Koyama et al.* 46 (KYO); Shizuoka, Akaishi Mts, from Mt Akaishi to Sawarajima, M. *Ito* 783 (KYO); Tagata-gun, Nakaidzu-cho, Amagi Mts, Mt Togasayama, N. *Fukuoka* 7245 (KYO); Gotenba City, near Jirouemonzuka, F. *Konta* & K. *Murata* 1171 (KYO); Gotenba City, In-no, near Otainai Bot. Gard., F. *Konta* 10777 (KYO); Izu, Kono, J. *Sugimoto* s.n. (KYO); Mukadake, J. *Sugimoto* s.n. (KYO); Inokawa, Y. *Saiki* 3076 (KYO). **Tokushima**: Miuma-gun, Ichiu-mura, from Kumadaira to Myotoike, M. *Hotta* 10805 (KYO); Miyoshi-gun, Mt Tsurugi, M. *Takahoshi* 1562 (KYO); Oe-gun, Koyadaira-mura, Mt Tsurugi, from Minokoshi to Kotsurugi-jinja, M. *Wakabayashi* & N. *Naruhashi* 117 (KYO); Mt Tsurugi, G. *Murata* 7905 (KYO). **Yamaguchi**: Koguchi, *Yuansongci* s.n. (KYO); Apu-gun, Tokusagamine, N. *Miake* s.n. (KYO); Apu-gun, Atoumachi, N. *Miake* 6062 (KYO). **Yamanashi**, Fujiyoshida City, Araya, F. *Konta* 11786 (KYO). **KOREA**: **Cham-gion**: Puz-ion Distr., 20 May 1897, V. L. *Komarov* s.n. (LE); *s. loc.*, in *Quercus* forest, 1 June 1897, V. L. *Komarov* s.n. (LE); *s. loc.*, 1,530 m, 18 June 1897, V. L. *Komarov* s.n. (LE). **Chongyang**, R. G. *Mills* s.n. (PE). **Chongsong**, G. *Koidzumi* s.n. (KYO). **Chungbuk**, Mt Worak, 13 May 1988, J. H. *Lee* s.n. (SNU). **Bor-orient**, J. *Ohwi* 2709(b) (KYO). **Ganwondo**: Mt Daeam, 28 Sep. 1969, Y. M. *Kang* s.n. (SNU); Musa, J. *Ohwi* 1043(a) (KYO); Changjin, N. *Nomura* s.n. (KYO); near Hamhung, J. *Ohwi* s.n. (KYO); Sanchong, F. *Igarashi* 23(?) (KYO). **Gyeonggye**: Kwangreung, 11 June 1936, T. H. *Chung* 10010 (SNU); Mt Bukham, Aug. 1937, B. S. *To* s.n. (SNU). **Gyeongsangnam**, Mt Chiri, 19 July 1969, J. H. *Ahn* s.n. (SNU). **Hamgyeongnam**: Sambang, 13 May 1934, B. S. *To* 4322 (SNU); *loc. eodem*, 17 May 1935, B. S. *To* 8730 (SNU); *loc. eodem*, 17 May 1936, B. S. *To* s.n. (SNU). **Jeju**: *s. loc.*, 28 July 1947, H. J.

Shim s.n. (SNU). **Pyeongnam**, *s. loc.*, 22 Aug. 1935, *B. S. To* s.n. (SNU). **Queyaert**: in forests, 800 m, 19 May 1910, *Taquet* 4104 (E); Hallaisan, 1908, *Taquet* 916 (E); Hoatien, 600 m, 18 Apr. 1908, *Taquet* 4942 (E). **Yallaisen**, 1,500 m, June 1907, *U. Faurie* 1711 (E). **RUSSIA, AMURSKAYA PROV.**, Amgun Basin, bank of Chukchagirsy Lake near Mt Vetkap, 24 June 1909, *I. W. Kisnetsow* 121 (LE). Amur Valley: upper reaches of Dichula River, steep slopes with birch woods, 19 Aug. 1910, *M. E. Semjagin* 98c (LE); upper reaches of Dichun River, clearings of mixed forests, 28 Aug. 1926, *E. Serpukhova* s.n. (LE); Vyatskoje Village, mixed forests, 16 May 1927, *A. Saverkin* 820 (LE). Amuro-Zejskoje Plato, M. Pera Basin, S of Klimoutzy Village, *Carex*–*Calamagrostis*–tall grassy *Quercus*–*Larix* forests with bushes, 2 Aug. 1957, *V. Lipatova & I. Petrova* s.n. (LE). Bidzhan Village: primary *Larix* woods in upper reaches of Lugovaya River, 8 June 1891, *S. Korshinsky* s.n. (LE); Biro-Bidzhan, Pompivcha Valley, oak and black-birch forests, 10 Sep. 1932, *S. Danilov* s.n. (LE). Mt Bureja: 1858, *G. Radde* s.n. (LE); in bushes, 1916, *M. Bykov* 9 (LE); Sutara Valley, near Lyubivinsky Mine, 15 June 1895, *V. L. Komarov* s.n. (LE). Bank of Dokka River, *Quercus*–*Populus*–*Betula* forest, 28 Aug. 1927, *A. Saverkin* 753 (LE). Near Nikolaevsk on Amur: hills with low forests and shrubs, 8 June 1910, *F. A. Derbek* s.n. (LE); Nikolaevsk on Amur, 4 July 1913, *V. Belousov* s.n. (LE). Watershed of Nora and Mamyn Rivers: NW of Tortalovo, along Nora River, in forests, Aug. 1908, *W. Dokturowsky* 5651 (LE); *loc. eodem*, Aug. 1908, *W. Dokturowsky* 5523 (LE); *loc. eodem*, E of Mamyn River, slopes, 10 Aug. 1908, *W. Dokturowsky* 5654 (LE). Seledmdzha Basin: Byssa River, 12 km above river mouth, 31 July 1927, *O. I. Kuzeneva* 222 (LE); between Perisk'e and Voznesenskoje villages, 1909, *H. von Oettingen* 1681 (LE). Udskey Distr.: on bank of Amur River, near Gilatzky camp 'Kojma', sunny places, 6 June 1905, *Korneev* 13 (LE); *loc. eodem*, 3 June 1905, *I. Sanotzky* 15 (LE); Van'kovskaya River, on hill near summit, 22 Aug. 1904, *I. T. Kryukov* 1381 (LE). Urkan Valley, *Betula latifolia* and *Larix* forests, *I. F. Kryukov* 1119 (LE). Zeja Basin: Tukuringra ridge, near Zeja-pristan, slope to springs, in bushes, 17 June 1914, *N. Prokhorov & O. I. Kuzeneva* 268 (LE); Bolotovo, rocky right bank of Zeja, 17 Aug. 1914, *N. Prokhorov & O. I. Kuzeneva* 772 (LE); Tom River, upper reaches, clearings of forests, 10 Aug. 1926, *O. I. Kuzeneva* 485 (LE); Gorbylsko-Zavitinsky forestry, watershed between B. and M. Gorbyl rivers, mixed forests, 30 Aug. 1926, *A. Krasnorutzkaya* 711 (LE). **KHABAROVSKY PROV.**, right bank of Ussuri, near Alexandro-Mikhajlovka Village, in mixed forests, 15 June 1909, *Warpakhowsky* s.n. (LE). Amur Basin: lower reaches of Nemptu River, *Larix* forests, 1 Aug. 1926, *A. Amosov* 375 (LE); lower reaches of Amur, between Permeksem and V. Tambovskoje villages, NE bank of Khurp Lake, *Populus*–*Betula* forests, 31 Aug. 1930, *N. Savich* 756 (LE). Birskoje Experimental Field: in woods, 22 June 1928, *Polevoi* 60 (LE); middle reaches of Elbina River, in dry birch forests, 2 June 1910, *I. W. Kusnetzov* 141 (LE). Gornotajozhaya Station, top of hill, N of B. Krivojklyuch, not rare, 19 May 1939, *A. Tolmachev* s.n. (LE). Imperatorskaya Gavan', 'Bai Hasshi', 30 Aug. 1855, *Kumetroff* s.n. (LE). Khabarovsk: among bushes and in forest meadows, 19 June 1902, *N. Desoulavy* 85 (LE); Nikolo-Alexandrovskoje Village near Khabarovsk, in forests, 20 July 1910, *E. S. Speshinova* 4 (LE); below Khabarovsk City, Amur River, 13 June 1909, *H. von Oettingen* 104 (LE); *loc. eodem*, 13 June 1909, *H. von Oettingen* 109 (LE), 110 (LE), 111 (LE), 112 (LE) and 113 (LE). **Nekrasovsky Distr.**, near Mikhajlovka Village, hills with mixed forests, 13 Sep. 1927, *O. Mamorina-Kiseleva* s.n. (LE). Okhotsky seashore, Nikolaya Bay, upper reaches of Arapa River, in forests, 22 Sep. 1931, *D. Vorobjov* 250 (LE). **Osipenko's Distr.**: 7–8 km S of Guga Village, *Picea*–*Populus*–*Larix* forests with grasses, 18 Aug. 1959, *A. S. Karpenko & L. M. Davydova* 63 (LE); *loc. eodem*, *Larix*–*Quercus*–*Picea* forests, SW slopes, 13 Aug. 1959, *A. S. Karpenko & L. M. Davydova* 44 (LE). Mt Pidán: clearings on ridge, 15 June 1927, *P. Desoulavy* 3591 (LE); bank of Syumigora Lake, in forests, 3 June 1910, *I. W. Kusnetzov* 99 (LE); bank of Tunguska River, 28 Aug. 1910, *I. W. Kusnetzov* 682 (LE); Troitzkoje Village on Amur, Dondona River, in forests, 16 June 1908, *N. Desoulavy* 1369 (LE); near Otradnoje Village, *Populus*–*Betula* forests, 3 Sep. 1928, *V. N. Vasiljev* 409 (LE); Udskey okr., lower reaches of Amur, Annenskije mineral springs, 12 June 1898, *N. Shestunov*

23 (LE). **KURILE ISLANDS, Isl. Shikotan:** 2–3 km S of Malokurilskoje Village, slopes, 12 July 1959, *E. Pobedimova & G. Konovalova* 713 (LE); Mt Shikotan, 1 July 1967, *E. M. Egorova & Sharomova* *E. A.* 3994 (LE); 2 km S of Krabozavodsk, on clearings with *Spiraea* and *Lonicera* between bamboos and birch forests, 23 July 1962, *A. Shreter* 587 (LE). **PRIMORSKY PROV.:** Amur Bay (Bai Victoria): 1 Sep. 1860, 1/13 Sep. 1860, *C. J. Maximowicz* s.n. (LE); Amur Bay near Vladivostok, forests, 15 June 1909, *E. S. Kusnetzova*, s.n. (LE). **Anuchinsky Distr.,** Partizan Village, coniferous forests, 10 June 1971, *O. Zhurba* 145 (LE). Ayan Bay, stony seashore, 20 June 1924, *E. Sokolova* s.n. (LE). Baranovsky siding, on bank of Suifun River, 26 Sep. 1984, *T. Krestovskaya* 235 (LE). Imansky uезд, 40–46 km E of Evgenjevka Station, upper reaches of Odarka River (Khanka Basin), in forests, 29 May 1911, *A. I. Chersky* s.n. (LE). ‘Kedrovaya Pad’ Reserve, Gakelevsky Spring, mixed forests, on slopes, 4 June 1950, *V. N. Vasiljev, E. V. Volkova & L. I. Ivanina* s.n. (LE). **Khankajsky Distr.,** near Alekseevka Village, 29 Sep. 1954, *G. F. Patrievskaya* s.n. (LE). Khekhtzir, meadow, 10 June 1926, *T. I. Solokhin* 928 (LE). Khooscyr Mts, Koreroovskaya, taiga, 31 Aug. 1909, *B. A. Fedtschenko* 798 (LE). **Lazovsky Distr.,** Glazkovka Village, 26 June 1976, *N. Prisezhnyuk* s.n. (LE). Mai-khe Basin: near Toskon factory, slope, in bushes, 30 Sep. 1926, *A. Malinova* 40 (LE); Mai-khe Basin, right bank of Mai-khe River, between Shkotovka and Surazhevka, W slope, 24 Sep. 1926, *A. Malinova* 41 (LE); Mai-khe Basin, Peishula, Koryavaya Valley, mixed forests, 25 Aug. 1950, *V. N. Vasiljev, E. V. Volkova & L. I. Ivanina* s.n. (LE); Mai-khe Basin, Peishuna, watershed between Lomazin and Pegaev springs, forests, 8 Aug. 1950, *E. V. Volkova & L. I. Ivanina* s.n. (LE). Monguchai Valley: near Ovchinnikovo Village, 24 May 1913, *N. Dyukina* 289 (LE); *loc. eodem*, Shirokaya Park, 24 May 1913, *N. Dyukina* 322 (LE). Nemtu Basin, Unka River, mixed forests, 16 June 1927, *V. L. Savich* s.n. (LE). Novik Bay, near Vladivostok, 1 Sep. 1860, *C. J. Maximowicz* s.n. (LE). Near Okeanskaya: in shade, 18 June 1924, *I. V. Popov* 53 (LE); near Okeanskaya, taiga, 4 Oct. 1909, *B. A. Fedchenko* 1184 (LE); NW slopes, in mixed groves, 31 May 1924, *I. V. Popov* 1 (LE). **Olginsky Distr.:** 45°N, near seashore, Aug. 1914, *N. P. Krylov* N III–42 (LE); Suchansky Mine, Suchan Valley, 28 June 1923, *Vasiljev* s.n. (LE); Olympiada Cape, 10 June 1915, *N. P. Krylov* N II–11 (LE); Olympiada Cape, 60 km from seashore, coniferous forests, 6 June 1916, *N. P. Krylov* N II–11 (LE). **N Possjetsky Distr.:** Narva Village, S slopes, in bushes, 13 June 1929, *A. Saverkin* 68 (LE); Sedemi Valley, Andrusovka Village, 29 June 1919, *N. P. Krylov* s.n. (LE). Putyatin Island, in woods, 31 May 1913, *A. Bulavkina* 142 (LE). Sedanka Station of Ussuri railway, mixed forests, 10 June 1923, *I. Shishkin* s.n. (LE). Mt Shishkovaya, 18 Sep. 1909, *B. A. Fedchenko* 1073 (LE). **Shkotovsky Distr.:** watershed between Pejshulla and Lutanga Rivers, *Abies–Picea* forests, 8 Sep. 1933, *A. Poretzky* 192 (LE); pass between Vesjoly and Molchanovka, 19 Sep. 1969, *Zhurba* 74 (LE). **Shmakovsky Distr.:** near Komarovka Village, right bank of Belaya River, 19 June 1928, *I. V. Zhiron* 663 (LE); Pavlo-Fedorovka Village, bushes on mountain slopes, 27 June 1928, *L. Nekrasova* 492 (LE). Sovietskaya Gavan’: 60 km from seashore, in valley, 6 July 1916, *N. P. Krylov* N I (LE); 60 km from seashore, coniferous forests, 6 July 1916, *N. P. Krylov* N 8a–III (LE). **Spassky Distr.:** 6.8 km SSW of Evseevka Village, forests on stony ground, 20 Sep. 1929, *I. V. Zhiron* 663 (LE); near farmstead Merkupovsky, in bushes, 17 Sep. 1928, *I. V. Zhiron* 839 (LE); near Vasilkovka Village, N slopes, *Populus tremula* forests, 6 Sep. 1928, *I. V. Zhiron* 694 (LE). Suchan River: near cape of Turang on Ussuri River, 1859, *R. K. Maak* s.n. (LE); Suchan, near Frolovka Village, Pengou Valley, taiga, 2 Aug. 1913, *A. B. Lavkina* 1393 (LE). **Suchansky Distr.:** Tzan-Dinza, in coniferous forests, 17 June 1923, *I. Shishkin* s.n. (LE); Partizan Station, upper reaches of Takhe River, 23 May 1964, *P. G. Gorovoi* s.n. (LE); Sungatsci, *R. Maak* s.n. (LE). **Suifunsky Distr.:** Nikolsk-Ussurijsk, creek N of Izvestkovy Ridge, 15 June 1927, *V. Transhel* 376 (LE); near Nikolsk-Ussurijsk, Mt Suifunskaya, 11 June 1927, *V. Transhel* 330 (LE); *loc. eodem*, 4 June 1920, *K. Mandl* s.n. (WU); Suifun Basin, upper reaches of Suputinka River, mixed forests, 4 June 1913, *V. L. Komarov* 1553 (LE); Suputinka Basin, Gornotajozhnaya Station Acad. Sci. USSR, mixed forests, 23 May 1950, *V. N. Vasiljev, E. V. Volkova & L. I. Ivanina* s.n. (LE); *loc. eodem*, mixed forests, 16 June

1951, *V. N. Vasiljev, E. V. Volkova & T. N. Gordeeva* s.n. (LE); Suputinsky Reserve, mixed forests on slopes, 24 May 1950, *V. N. Vasiljev, E. V. Volkova & L. I. Ivanina* s.n. (LE); *loc. eodem*, Mt Zmeinka, mixed forests, 24 May 1974, *Kolodkina* s.n. (LE). B. Ternej, in bushes, 17 Aug. 1906, *N. A. Palczewski* 144 (LE). Tionsky Ridge, mixed forests, 8 Sep. 1909, *H. von Oettingen* 1037 (LE).

Vladivostoksky Region: Muravjov Amursky Peninsula, upper reaches of Tavajza River, 9 Sep. 1929, *V. Transhel* 1223 (LE); Vtoraya River, meadows, 21 Aug. 1930, *Torba* 684 (LE); Russky Island, in broad-leaved forests, 27 May 1922, *N. A. Desoulavi* 283 (LE); Russky Island, in forests, 23 June 1922, *N. A. Desoulavi* 284 (LE); Russky Island, S of Vladivostok, 19 June 1922, *N. P. Krylov* 410 (LE); near Vladivostok, near Nakhodka, in taiga, 30 May 1901, *N. A. Palchevsky* s.n. (LE); upper reaches of M. Elduga River, 47 sq. of Nezhinskoje Forestry, mixed forests, N slope, 29 June 1930, *D. Vorobjov* 419 (LE); B. Elduga valley, 20 May 1930, *Torba* 31 (LE); middle reaches of Vtoraya River, NE slope, mixed forests, 28 July 1930, *Torba* 834 (LE); upper reaches of Sanduga River, in 18 sq. of Nezhinskoje Forestry, mixed forests, N slopes, 12 July 1930, *D. Vorobjov* 490 (LE); upper reaches of Bolshaya Elduga River, 55 sq. of Nezhinskoje forestry, mixed forest, 13 July 1930, *D. Vorobjov* 37 (LE); middle reaches of Pervaya River, mixed forest, N slopes, 9 Aug. 1930, *D. Vorobjov* 1120 (LE); on road from taiga to piket Vodorazdelny, 10 June 1925, *Mamotina* s.n. (LE); near Voznesenskoje Village, in thickets of *Acer tegmentosum* and *A. ukurunduense*, 21 Sep. 1904, *H. von Oettingen* 2312 (LE).

SAKHALIN, near Aleksandrovsky Port, July 1893, *L. Y. Shternberg* 143 I (LE). Armudan Valley, *Larix-Picea* burned forests, 10 Aug. 1926, *V. Korzhevin* s.n. (LE). Dai: 18 June 1860, *F. Schmidt & Glehn* s.n. (LE); near Dai, 1860, *Brylkin* s.n. (LE); Dai, 18 June 1860, *F. Schmidt* s.n. (LE); Dolinsky Distr., near Dolinskoe Village, mixed forests on ridge, 17 June 1952, *L. V. Morde* s.n. (LE); 6 km from port Due, on Verbluzhy Ridge, in forest near timberline, 6 June 1880, *Augustinowicz* s.n. (LE); Due, June 1860, *Glehn* s.n. (LE); near Due, 17 June 1872, *Augustinowicz* s.n. (LE); Due, c. 1 km from seashore, burned places on stony slopes. 1 June 1872, *O. Augustinowicz* s.n. (LE); Due, on slopes, 1 June 1872, *O. Augustinowicz* s.n. (LE). Kassunai, 20 June 1860, *Glehn* s.n. (LE). Korsakof, 10 Sep. 1908, *Faurie* 460 (LE). On Lopatinskie Mts, E ridge, 4 Sep. 1871, *Mizul* s.n. (LE). Kholmsky Distr.: near Ozhidajevo Village, woodlands on S slopes, 15 Sep. 1955, *K. A. Andreev* 444 (LE); E coast, Mt Nupuripo, *T. Moualt* s.n. (SAPS). W coast, Notasan (Mauka), *T. Miyake* s.n. (SAPS). Mt Kasipo, *S. Sakhalin, G. Takee, H. Abumiya & Y. Hoshiro* s.n. (SAPS). Near Mutnyanka, June 1903, *M. Trigoni* 79 (LE). Nevelsky Distr., Kuznetzovo Village, Southern-Sakhalin Reserve, mixed forests, 6 June 1950, *S. Kravchenko* s.n. (LE). Ninaussi, 1 Sep. 1860, *Glehn* s.n. (LE).

Tomarinsky Distr.: near Urozhajnoje, Listvennaya Valley, low forests 6 km above village, 6 Sep. 1955, *K. A. Andreev* 364 (LE). Vladimirovo, near forests, June 1908, *Faurie* 468 (LE). Yuzhno-Sakhalinsk: near Konuma Village, in bushes, May 1948, *M. G. Popov* s.n. (LE); Tankovoje creek opposite Lugovoje Village, slopes, 22 July 1948, *M. G. Popov* s.n. (LE); between Yuzhno-Sakhalinsk and Alexandrovka Village, swampy forests near Comprehensive Institution of Acad. Sci. USSR, 12 June 1959, *E. Pobedimova & G. Konovalova* 179 (LE).

SIKHOTE: Botchi Valley, 3rd camp, forests, 20 Aug. 1924, *I. Shishkin* 209 (LE); Botchi Valley, 15 km from mouth of river, 19 July 1924, *V. M. Savich* 456 (LE); Botchi Valley, 3 km from mouth of river, *Abies-Picea* forests, 11 July 1924, *V. M. Savich* 88 (LE); Botchi Valley, near Kukchi, *Abies-Picea* forests with shrubs, 27 July 1924, *V. M. Savich* 824 (LE); Botchi Valley, 3 km from mouth of river, *Abies-Picea* forests, 11 July 1924, *V. M. Savich* 38 (LE); Botchi Valley, near Kukchi, *Abies-Picea* forests with shrubs, 27 July 1924, *V. M. Savich* 833 (LE); Botchi Valley, 15 km from mouth of river, 19 July 1924, *V. M. Savich* 457 (LE). Koppa Basin: Sanchku River, forests on N slopes with *Rhododendron*, 23 Aug. 1924, *V. M. Savich* 2004 (LE); Middle Sikhote-Alen, Sikhote-Alen Reserve, upper reaches of Takema River, Yasnaya Polyana, *Vicia*-grass meadows, 9 Aug. 1937, *B. Kolesnikov* 40 (LE); *loc. eodem*, Sitza River, Zakharovsky Spring, *Pinus*-broad-leaved forests, May 1935, *Y. A. Sallin* 405 (LE); *loc. eodem*, Mt Shishkish, meadows with *Diervilla*, 16 Aug. 1935, *N. Kolesnikov* 93 (LE).

Tumnina Basin, coniferous forests, along Khuenku Stream, 13 July 1934, *V. Sochava* s.n. (LE).

15b. *Paeonia obovata* Maxim. subsp. *willmottiae* (Stapf) D. Y. Hong & K. Y. Pan in Hong *et al.*, *Pl. Syst. Evol.* 227: 134 (2001). Basionym: *Paeonia willmottiae* Stapf, *Bot. Mag.* 142: tab. 8667 (1916). *Paeonia obovata* Maxim. var. *willmottiae* (Stapf) Stern, *J. Roy. Hort. Soc.* 68: 128 (1943); Stern, *Study Gen. Paeonia*, 76 (1946); Halda, *Gen. Paeonia*, 110 (2004). TYPE: "Miss Willmott May 22.1915" [from the garden of Miss Willmott at Warley Place, Essex, England, but originally from China] (lectotype designated by Hong *et al.* 2001c: 134, K!).

PHENOLOGY. Flowering in May; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 20$ (Hong *et al.*, 2001c).

HABITAT AND DISTRIBUTION. Growing in broad-leaved deciduous forests mainly on granites, but also on other media such as sandstones and basalts, at altitudes from 800 to 2,800 m. Endemic to China, confined to the mountain area around the Qinling Range: NE Chongqing, W Henan, W Hubei, S Ningxia, Shaanxi, Shanxi, and N Sichuan.

DIAGNOSTIC CHARACTERS. Subspecies *willmottiae* in *Paeonia obovata* is characterised by tetraploidy (Hong *et al.*, 2001c: 134). In contrast to the typical subspecies, the leaves are mostly densely or very densely hirsute or pubescent on the lower surface.

ADDITIONAL SPECIMENS EXAMINED. **CHINA, CHONGQING, Chengkou:** *s. loc.*, 2,000 m, *R. P. Farges* 566 (LE); Nanxi, Gaopo, 1,650 m, 1958, *T. L. Dai* 101441 (PE, SZ). **WUSHAN,** Chaoyangping, 3 May 1956, *G. H. Yang* 57903 (PE). **WUXI:** Hongchiba, 1,500 m, 25 Apr. 1998, *Z. Y. Liu* H98039 (A, CAS, K, MO, PE, US); *loc. eodem*, 1,900 m, 27 Aug. 1958, *G. H. Yang* 59350 (PE, SZ). **HENAN, Lushi:** Shiziping, Dakuaidi (Qihe Forest Farm), 1,550 m, granites, clearings, 16 May 1998, *D. Y. Hong*, *S. Y. Wang*, *K. Y. Pan* & *G. Y. Rao* H98006 (A, CAS, K, MO, PE, US); *loc. eodem*, *D. Y. Hong*, *S. Y. Wang*, *K. Y. Pan* & *G. Y. Rao* H98007 (MO, PE); *loc. eodem*, 1,800 m, 7 July 1959, *s. coll.* 34431 (PE). **Songxian:** Longchiman, Erdaotianmen, 21 Sep. 1959, *Henan Forest Bureau* 1108 (PE); Longchiman, W of Diaozhongyao, 1,900 m, in dense forests, 15 Aug. 1959, *s. coll.* 34768 (PE); Longmao, 1,400 m, 30 Aug. 1960, *K. C. Kuan* & *T. L. Dai* 2418 (PE); near Wumashi Forest Farm, 1,680 m, 13 Sep. 1960, *K. C. Kuan* & *T. L. Dai* 2582 (PE); Yangshan, Yangjiaohao, *D. Y. Hong* & *Y. Z. Ye* H94004 (PE); Yangshan, Shigunping, *D. Y. Hong*, *Y. Z. Ye* & *Y. X. Feng* H97002 (PE) and H97003 (PE, MO). **Xixia:** Taiping Township, Xixin, Erdaogou, 1,300 m, on rocks, 14 May 1959, *s. coll.* 536 (PE); Erlangping Township, Wantancun, Waitoushan, 1,200–1,400 m, *Quercus* forests, granites, 15 May 1998, *D. Y. Hong*, *S. Y. Wang*, *K. Y. Pan* & *G. Y. Rao* H98004 (A, CAS, K, MO, PE, US); Xixia, 1,600–1,800 m, 14 May 1988, *J. Z. Qiu* PB88101 (PE), PB88104 (PE), PB88105 (PE) and PB88106 (PE); *loc. eodem*, 1,700 m, 17 May 1988, *J. Z. Qiu* PB88201 (PE), PB88202 (PE), PB88203 (PE); *loc. eodem*, 1,600 m, in forests, 14 May 1988, *J. Z. Qiu* PB88301 (PE), PB88302 (PE), PB88305 (PE) and PB88501 (PE). **Yiyang:** *s. loc.*, 1959, *Xinxiang Normal College Exped.* 23121 (PE) and 23713 (PE); *s. loc.*, 8 Aug. 1959, *General Plants Exped.* 1252 (PE). **HUBEI, s. loc.**, Henry 5365 (E). W Hubei (Hupeh), *E. H. Wilson* 359 (E). **Badong:** Tianziping, 1,800 m, 14 May 1958, *G. H. Yang* (SZ); Luoping, 1,840 m, 6 Oct. 1952, *Q. L. Chen et al.* 1920 (PE). **Baokang:** Houping Township, Chefengping, *D. Y. Hong*, *Y. Z. Ye* & *Y. X. Feng* H97030 (PE); Houping Township, Wudaoxia, *D. Y. Hong*, *Y. Z. Ye* & *Y. X. Feng* H97046 (PE); Dashui Forest Farm, *D. Y. Hong*, *Y. Z. Ye* & *Y. X. Feng* H97050 (MO, PE). **Fangxian,** *E. H. Wilson* 631 (K, LE). **Shennongjia (Songbai):** near the town, *J. Z. Qiu* PB88016 (PE), PB88017 (PE), PB88018 (PE), PB88019 (PE), PB88020 (PE) and PB88103 (PE); Shennongjia, Songbai, Shantunya, 2,000 m, Aug. 2004, *D. Y. Hong* & *Z. Q. Zhou* H04044 (PE); Shantunya, *J. Z. Qiu* PB88022(PE). **Xingshan,** Laojunshan, in forests, 8 May 1957, *Y. Liu* 570 (PE). **NINGXIA,** Jingyuan, *Inst. Drug Control. Jing* 0059 (PE). **SHAANXI,** Foping: Damahe, Fuziling, 21 June 1952, *P. C. Kuo* 1493 (PE). **Shaanxi-Gansu Basin,** *T. Y. Le* s.n. (PE). **Huashan,** 12 June 1939, *T. N. Liou* 10887(PE). **Longxian,** Kuanshan (Kwanshan), 1,900 m, in forests, 6 June 1936, *T. P. Wang* 4227 (PE). **Shangxian,** Qinwang Shan, Shegou, 1,600 m, in forests, 21 Aug. 1952, *T. P. Wang* 16283 (PE). **Taibai Shan:** *s. loc.*, 10 Oct. 1955, *Q. Hong* & *Y. S. Huang* 158 (PE); near Dadian

Temple, in forests, Sep. 1938, *W. Y. Hsia* 4598 (PE); Liouchiaya to Chunshanzu, 1,400 m, 28 Apr. 1939, *K. T. Fu* 2583 (PE); Shangbaiyun, *D. Y. Hong & X. Y. Zhu* PB85067 (PE); *loc. eodem*, *D. Y. Hong & X. Y. Zhu* PB85068 (PE); *loc. eodem*, *D. Y. Hong, Y. Z. Ye & Y. X. Feng* H97056 (PE) and H97057 (PE); *loc. eodem*, *X. Y. Zhu & Z. H. Wu* PB85085 (PE); Haopingshi, 1,100 m, 1933, *T. P. Wang* 1588 (PE); Zhongshanshi, *Qinling Exped.* 182 (PE); *loc. eodem*, *C. G. Ma et al.* 68 (PE); Longmenhe, *W. L. Chen* H98040 (A, K, MO, PE, US). **SHANXI**, *s. loc.* 1929, *T. Tang* 963 (PE); *X. Y. Zhu* 89015 (PE). **Huoxian**: Mt Huoshan, Qiliyu, 1,800–2,000 m, 7 June 1957, *Huanghe Exped.* 762 (PE); Mt Huoshan, above Yanjiaping, near the forest farm, 1,800–1,900 m, granites, *Quercus–Sorbus–Acer* forests, 19 May 1998, *D. Y. Hong, K. Y. Pan & G. Y. Rao* H98010 (A, K, MO, PE, US); Qianlingbei, *J. Z. Qiu* PB85090 and PB85091 (PE); Taiyue Forest Farm, *J. Z. Qiu* P1–P7 (PE). **Jiaocheng**, Mt Kuandi, Hengjian, Tashangcun, 1,700 m, 3 Sep. 1960, *X. Y. Liu* 21363 (PE). **Jishan**; Xishe, *J. Z. Qiu* PB88501 (PE); *loc. eodem*, *J. Z. Qiu* PB89301, PB89401, PB89501 and PB89601 (PE). **Ningwu**: Dongzhai, Majiazhuang, Yuanwading, 2,150 m, in forests, 15 Sep. 1957, *Shanxi Exped.* 265 (PE). **Qinxian**: Yushuiquan, Mt Shigao, 31 July 1959, *K. C. Kuan & Y. L. Chen* 983 (PE). **Wutai Shan**: Taihuei Town, Zhenhaisi Temple, 1,700 m, sparse pine woods, 20 May 1998, *D. Y. Hong, K. Y. Pan & G. Y. Rao* H98013 (A, CAS, K, MO, PE, US); *loc. eodem*, 28 June 1959, *K. C. Kuan & Y. L. Chen* 1562 (PE). **Yangcheng**: Zhangui, in forests, 28 July 1959, *S. Y. Bao* 2148 (PE); Mt Yunmong, 18 May 1959, *S. Y. Bao* 151 (PE). **Yicheng**: Dahe, Beishenyu, 1,600 m, 13 May 1957, *Huanghe Exped.* 202 (PE). **Yuanqu**: Mt Lishan, Houwentangcun to Shunwangping, 1,550–2,100 m, sandstones, in forests, 18 May 1998, *D. Y. Hong, K. Y. Pan & G. Y. Rao* H98009 (A, CAS, K, MO, PE, US); Shunwangping, 26 May 1959, *S. Y. Bao* 250 (PE); *loc. eodem*, 1,600 m, in forests, 14 June 1959, *S. Y. Bao* 302 (PE). **SICHUAN**, **Heishui**: Duifengshan, 2,800 m, in thickets, 27 July 1957, *X. Li & J. X. Zhou* 73835 (PE, SZ); Forest Farm, 2,300–2,400 m, in forests, 2 July 1959, *S. Jiang & C. L. Jin* 1526 (PE). **Maoxian**: *s. loc.*, 13 July 1952, *Z. He* 13549 (PE, SZ); Maoxian to Lixian, 1952, *Z. He & Z. L. Zhou* 13120 (PE, SZ). **Nanping**: Wujiao, 1,900 m, 6 July 1979, *s. coll.* 630 (SM). **Wenchuan**: Wolong Nature Reserve, *D. Y. Hong & X. Y. Zhu* PB85024 (PE); Weizhou, 2,000 m, 2 May 1959, *Chuan-Econom. A* (59) 2011 (PE, SZ). **Zoige**: *s. loc.*, 2,800 m, 9 Aug. 1965, *s. coll.* s.n. (SM).

16. *Paeonia cambessedesii* (Willk.) Willk. in Willkomm & Lange, *Prodr. fl. hispan.* 3: 976 (1880), in obs.; Willkomm, *Ill. fl. hispan.* 1: 104, tab. 65a (1883); Hutchinson, *Bot. Mag.* 133: tab. 8161 (1907), pro parte, excl. pl. Cors.; Stern, *Study Gen. Paeonia*, 62 (1946); Cullen & Heywood in Tutin *et al.*, *Fl. Europ.* 1: 244 (1964); Barceló, *Fl. Mallorca* 2: 174 (1978); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 294 (1993); Muñoz-Garmendia & Navarro in Castroviejo *et al.*, *Fl. Iberica* 3: 145 (1993). *Paeonia corallina* Retz. var. *cambessedesii* Willk., *Österr. Bot. Z.*, 25: 113 (1875); Huth, *Bot. Jahrb. Syst.* 14(3): 267 (1891). *Paeonia mascula* (L.) Mill. subsp. *cambessedesii* (Willk.) O. Bolòs & Vigo, *Bull. Inst. Cat. Hist. Nat. (sect. Bot.)* 38: 65 (1974). TYPE: Isl. Balears: Mallorca, Feb. 1827, *J. Cambessèdes* s.n. (lectotype here designated, K!)

Paeonia corallina Retz. var. *fructibus glabris* Cambess., *Enum. pl. Balear.*, 33 (1827). TYPE: not designated.

Paeonia corallina Retz. f. *leiocarpa* auct. non Coss. (1850): Knoche, *Fl. Baléar.* 1: 474 (1921).

Paeonia corallina auct. non Retz. (1783): Amo y Mora, *Fl. fan. Penins. Iberica* 5: 745 (1873).

Paeonia corsica auct. non Sieber ex Tausch: Halda, *Gen. Paeonia*, 90 (2004), pro parte, quoad pl. Balear. Isl.

Perennials, glabrous throughout. Caudex occasionally elongated, forming rhizomes up to 15 cm long. Roots carrot-shaped. Stems mostly purple, less frequently green, 30–50 cm tall. Lower leaves biternate, with 9, rarely 8 or 7, leaflets; leaflets never segmented, ovate, oblong, or ovate-lanceolate, cuneate at the base, obtuse or acute at the apex, 6–11 cm long, 3–6 cm wide, mostly purple beneath. Flowers solitary and terminal; involucre bracts mostly 2, less frequently 1 or 3, occasionally absent; sepals usually 3, less frequently 2 or 4 in number, rounded



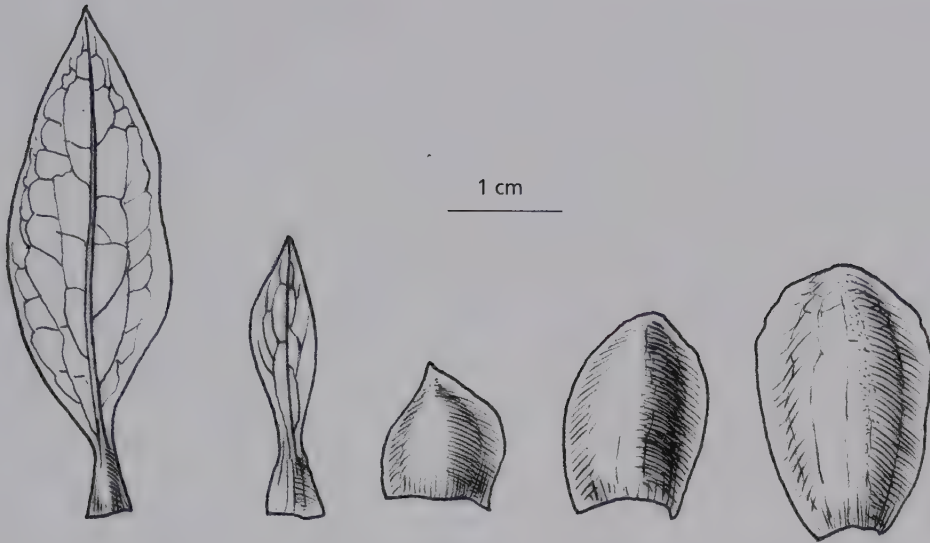


Fig. 5.16B *Paeonia cambessedesii* (Willk.). Willk.: involucrate bracts and sepals, based on A. Fridlender H01002 (MO, PE). Drawn by Mr SUN Yin-Bao.

but sometimes one of them acute or caudate at the apex, purple; petals pink, 5–8 in number; filaments purple, anthers yellow; disk waved, 1 mm high; carpels 3–8, but mostly 4–6 in number; styles 1–2 mm long; stigmas 1–1.5 mm wide. Follicles ellipsoid-columnar, 3–4 cm long, 1–1.8 cm wide. Seeds spherical, black, c. 5 mm in diameter. Figs 5.16A, 5.16B.

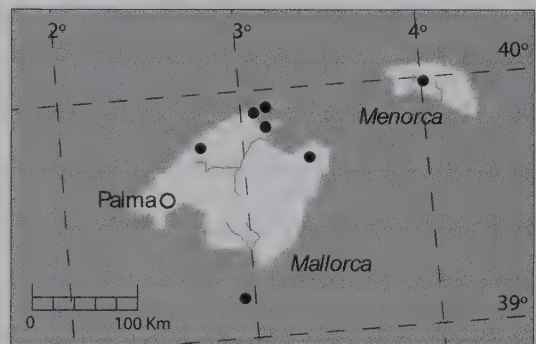
PHENOLOGY. Flowering from October to April of next year; fruiting in June or July.

CHROMOSOME NUMBER. $2n = 10$ (Barber, 1941; Dark, 1936; Stern, 1944; the present work with the voucher: Spain, Mallorca, D.

Y. Hong & X. Q. Wang H01025 (A, BM, CAS, K, MO, P, PE)).

HABITAT AND DISTRIBUTION. Growing in calcareous soils with shrubs or grasses at altitudes from 20 to 1,400 m. Confined to the Balearic Islands; endemic to Spain (Map 5.16). As far as we are aware, the species is growing at a few sites on Mallorca, on a small island, Cabrera, and on Menorca. In 2001, we visited the port of Pollença of Mallorca and found a population with only about 100 individuals near the tunnel. This species is surely one of the most endangered peonies.

NOTES. *Paeonia cambessedesii* has three distinct characters: 1) glabrous throughout; 2) leaflets 9 or even fewer in number, never segmented; 3) a large number of carpels, which easily distinguish it from all of its allies. The species has the smallest number of leaflets in the genus, and the greatest number of carpels in section *Paeonia*. Another characteristic of this species is the mostly purple colour of the lower side of the leaf.



Map 5.16. Distribution of *Paeonia cambessedesii* (Willk.) Willk.

Fig. 5.16A (opposite). *Paeonia cambessedesii* (Willk.) Willk.: **a**, carrot-shaped roots (drawn by Miss LI Ai-Li); **b**, a lower leaf; **c**, a flower; **d**, a flower with stamens and petals shed, showing disk and five glabrous carpels (**b–d** drawn by Miss CAI Shu-Qin).

ADDITIONAL SPECIMENS EXAMINED. SPAIN, BALEARIC ISLANDS, CABRERA: 7 June 1933, *Maren* s.n. (BC); Es Frare, 20 Mar. 1976, *E. Velasco* s.n. (BC); Aguila al Puerto, 29 Apr. 1948, *P. Ferrer* s.n. (MA); *loc. eodem*, 29 May 1948, *P. Ferrer* s.n. (MA); Grieta N del Acartilado, 21 Apr. 1973, *J. Limenez, H. Gutierrez, T. Tarazona et al.* s.n. (MA). **MALLORCA (Majorca):** *s. loc.*, 29 Apr. 1948, *P. Ferrer* 6 (G). **Alcudia:** 26 June 1852, *Marés* s.n. (G); the peninsula, N of Ermita, NW slopes, 25 Apr. 1968, *G. Nordborg & R. Dahlgren* 487 (LD). **Las Basas, c.** 300 m, 1 Mar. 1936, *G. E. Martindale* 146 (K). **Pollença:** 1 km W of Cap de Formentor light house, N of road, also on cliffs of eroded limestone, 100 m, 20 Jan. 1971, *L. F. Ferguson* 3067 (BM); just N of entrance to the tunnel from Pollença to Cap de Formentor, N of Fumal, 21 Jan. 1971, *L. F. Ferguson* 3069 (BM); *loc. eodem*, 70 m, 14 June 2001, *D. Y. Hong & X. Q. Wang* H01025 (A, BM, CAS, K, MO, P, PE); Cap de Formentor, c. 100 m, 19 May 1985, *L. Bastil* s.n. (GZU); 4 May 1929, *M. E. Edmonds* 228 (K); Boca de Vaca, 39°50'N, 3°5'E, Oct. 1923, *L. S. Gibbs* 4005 (BM); Ariant, near Pollença, 8 May 1899, *C. Bicknell* s.n. (BM); Cap de Formentor, limestones, 200 m, 16 Apr. 1971, *F. Krendl* s.n. (W); 13 Mar. 1935, *P. B. Kennedy* 901 (US). **Mt Puig Major**, summit, 16 May 1869, *E. Bourgeau* s.n. (K, P). **Soller:** 50–1,400 m, 11 May 1911, *H. Bianor* 11 (E); *s. loc.*, 40–1,300 m, May–June 1885, *Porta & Rigo* s.n. (G, K); Hassavella, 1,200 m, 17 June 1962, *J. Orell Casanovas* s.n. (G); Mt Fumat, 20–150 m, limestones, 18 Apr. 2001, *A. Fridlender* H01002 (A, BM, CAS, K, MO, PE); *loc. eodem*, 17 Apr. 2001, *A. Fridlender* H01008 (PE). **Mt Tossals**, W slopes in upper parts, 25 Apr. 1968, *G. Nordborg & R. Dahlgren* 738 (LD). **Traida de Arta(?)**, May 1942, *P. Ferrer* s.n. (MA). **MENORCA (Minorca):** Barnanco de Algendar, 25 Apr. 1903, *J. W. White* s.n. (E); Barranc de Binicudrell-Sur Mendra, Apr. 1980, *Ernesto Felix* s.n. (MA); Ferrerias, 1900, *A. Pons Y. Guerau-Mahón* s.n. (MA); Rafal-Fort(?), 7 May 1900, *A. Pons Y. Guerau-Mahón* s.n. (MA).

- 17. *Paeonia corsica*** Sieber ex Tausch, *Flora* 11: 88 (1828); Baker, *Gard. Chron.* ser. 3, 21: 780 (1884); Halda, *Gen. Paeonia*, 90 (2004), pro parte, excl. pl. Balear. Isl.; Hong & Wang, *Feddes Repert.* 117 (1–2): 79 (2006). *Paeonia corallina* Retz. var. *corsica* (Sieber ex Tausch) Coss., *Comp. fl. atlant.* 2: 53 (1887). *Paeonia corallina* Retz. f. *corsica* (Sieber ex Tausch) Rouy & Foucaud, *Fl. France* 1: 144 (1893). *Paeonia officinalis* L. subsp. *corallina* (Retz.) Fiori var. *corsica* (Sieber ex Tausch) Fiori in Fiori & Paoletti (eds): *Fl. Italia* 1: 527 (1898). *Paeonia mascula* (L.) Mill. var. *corsica* (Sieber ex Tausch) Gürke in Richter (ed.): *Pl. Eur.*, 401 (1903), pro parte, quoad pl. Cors. TYPE: Corsica, “monte Cagna ad Porto vecchio in Corsica”, Sieber s.n. (holotype P!; isotype K!) *Paeonia glabrescens* Jord. in Jordan & Fourreau, *Icon. fl. Eur.* 2: 38, tab. 323 (1903). TYPE: Jordan’s tab. cited (holotype!). *Paeonia revelieri* Jord. in Jordan & Fourreau, *Icon. fl. Eur.* 2: 38, tab. 322 (1903). TYPE: Jordan’s tab. cited (holotype!). *Paeonia morisii* Cesca, Bernardo & Passalacqua, *Webbia* 56(2): 229 (2001). TYPE: Sardinia: Nuoro, Gennargentu, Mt D’Iscudu, 1,300 m, 22 June 1996., *L. Bernardo & N. G. Passalacqua*, s.n. (holotype CLU, n.v.; isotypes FI, PAL, SS). *Paeonia russoi* auct. non Biv.: Stern, *Study Gen. Paeonia*, 63 (1946), pro parte, quoad pl. Cors. & Sardin. *Paeonia russoi* Biv. var. *reverchonii* Legrand, *Bull. Assoc. Franc. Bot.* 2: 62 (1899). TYPE: Corsica: Serra di Scopamène, near Sartene, 4 June 1879, *E. Reverchon* 218 (holotype P!; isotypes BM!, F!, G!, K!, M!, P!, WU!). *Paeonia mascula* (L.) Mill. subsp. *russoi* (Biv.) Cullen & Heywood, *Feddes Repert.* 69: 35 (1964), Cullen & Heywood in Tutin *et al.* (eds): *Fl. Europ.* 1: 244 (1964), pro parte, quoad pl. Cors. & Sardin.; Tzanoudakis, *Cytotax. Stud. Gen. Paeonia in Greece*, 30 (1977); Stearn & Davis, *Peonies Greece*, 87 (1984); Akeroyd in Tutin *et al.* (eds): *Fl. Europ.* edn 2, 1: 294 (1993), pro parte, quoad pl. Cors., Sardin. & Occid. Graec. *Paeonia mascula* (L.) Mill. var. *russoi* (Biv.) Gürke in Richter (ed.): *Pl. eur.*, 401 (1903), pro parte, quoad pl. Cors. & Sardin. *Paeonia corallina* Retz. var. *russoi* (Biv.)

- Coss., *Comp. fl. atlant.*, 2: 53 (1887), pro parte, quoad pl. Cors. & Sardin. *Paeonia corallina* Retz. f. *russoi* (Biv.) Rouy & Foucaud, *Fl. France* 1: 144 (1893), pro parte, quoad pl. Cors.
- Paeonia officinalis* L. subsp. *corallina* (Retz.) Fiori var. *mascula* (L.) Fiori in Fiori & Paoletti (eds): *Fl. Italia* 1: 527 (1898), pro parte, quoad pl. Cors. & Sardin.
- Paeonia corallina* Retz. f. *ovatifolia* (Boiss. & Reut.) Rouy & Foucaud, *Fl. France* 1: 144 (1893), pro parte, quoad pl. Cors. *Paeonia mascula* (L.) Mill. var. *ovatifolia* (Boiss. & Reut.) Gürke in Richter (ed.): *Pl. eur.*, 401 (1903), pro parte, quoad pl. Cors. *Paeonia corallina* Retz. var. *broteri* Boiss. & Reut. f. *ovatifolia* (Boiss. & Reut.) Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 551 (1923), pro parte, quoad pl. Cors.
- Paeonia corallina* Retz. var. *pubescens* Moris, *Fl. Sardoia* 1: 64, tab. 4 (1837). TYPE: Corsica: Foret de Perticato, 1822, Soleirol s.n. (holotype G!).
- Paeonia corallina* Retz. var. *pubescens* Moris f. *hypoleuca* Briq., *Prodr. fl. Corse* 1: 581 (1910). *Paeonia corallina* Retz. var. *russoi* (Biv.) Coss. f. *hypoleuca* (Briq.) Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 551 (1923), pro parte, quoad pl. Cors. & Sardin. TYPE: Corsica: "Cap Corse: maquis de la Pointe de Golfidoni et du Monte Fornello, versants E. 400–575 m", 27 Apr. 1907, J. Briquet et al. s.n. (lectotype designated by Hong & Wang 2006: 80, G!).
- Paeonia corallina* Retz. var. *leiocarpa* Coss., *Notes. pl. crit.* 2: 50 (1850). *Paeonia russoi* Biv. var. *leiocarpa* (Coss.) Stern, *J. Roy. Hort. Soc.* 68: 126 (1943); Stern, *Study Gen. Paeonia*, 66 (1946). TYPE: Corsica, Mt Cagna, Borioli, 18 July 1849, L. Kralik s.n. (holotype P!).
- Paeonia corallina* Retz. var. *cambessedesii* auct. non Willk.: Huth, *Bot. Jahrb. Syst.* 14(3): 267 (1891), pro parte, quoad pl. Cors.
- Paeonia cambessedesii* auct. non Willk.: Briquet, *Prodr. fl. Corse* 1: 581 (1910) (pro syn.).
- Paeonia corallina* Retz. f. *triternata* (Pall. ex DC.) Rouy & Foucaud, *Fl. France* 1: 144, 145 (1893), quoad nom., non Pall. ex DC.
- Paeonia officinalis* L. subsp. *corallina* (Retz.) Fiori var. *triternata* (Pall. ex DC.) Fiori in Fiori & Paoletti (eds), *Fl. Italia* 1: 527 (1898), quoad nom.
- Paeonia coriacea* auct. non Boiss.: Zángheri, *Fl. Italica* 1: 169 (1976), pro parte, quoad pl. Cors. & Sardin.
- Paeonia mascula* (L.) Mill. subsp. *coriacea* (Boiss.) Malag. sensu Schmitt, *Pl. Mont.* 12(181): 179 (1997), pro parte, quoad pl. Cors. & Sardin.

Perennials. Roots thickened, carrot-shaped, attenuate downwards, up to 2 cm in diameter, grey-brown. Stems 35–80 cm tall, with 5–7 scales at the base, glabrous, green or green but partially purple, or nearly entirely purple. Petioles green, partially purple or entirely purple, glabrous or villose; lower leaves biternate, with 9 leaflets, leaflets rarely segmented nearly to the base, thus leaflets/leaf segments mostly 9, less frequently 10, 11, very rarely more (up to 20), ovate to elliptic, 4–13 cm long, 2–8 cm wide, cuneate to nearly truncate at the base, acute at the apex, always glabrous above, but mostly rather densely, less frequently sparsely villose number, leaf-like; sepals 2–8, but mostly 3–5 in number, unequal in size, green or green but purple at the periphery to entirely purple, ovate-orbicular, with one or two (rarely three) acute while the rest rounded at the apex, rarely one caudate at the apex; petals 7–8 in number, rose, obovate; filaments purple; anthers yellow; disk 1 mm high, waved, tomentose on flowers with tomentose carpels; carpels 1–8, but mostly 2–5 in number, green, purple or red, hispidulous, with hairs 1.5 mm long, brown-yellow, rarely glabrous, the widest above the middle; styles 1.5–3.0 mm long; stigmas red, 1–1.5 mm wide. Seeds ovoid-spherical, black, c. 7 mm long, 5–6 mm in diameter. Figs 5.17A, 5.17B.

PHENOLOGY. Flowering from late April to late May; fruiting from late July to September.

CHROMOSOME NUMBER. $2n = 10$ (Tzanoudakis, 1977, 1983; Cesca et al., 2001; Hong & Wang, 2006).

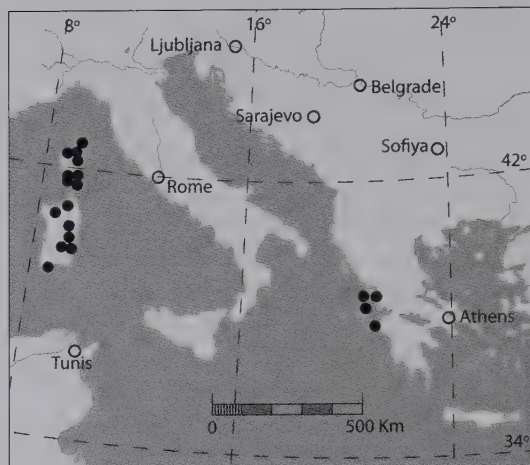
HABITAT AND DISTRIBUTION. Found from 400 to 1,700 m in altitude; in a variety of communities, oak and pine forests, maquis, and herbs; on various media, limestones, granites and metamorphic rocks. Confined to Corsica (France), Sardinia (Italy), and the Ionian Islands and Akarnania Province (Greece) (Map 5.17).

NOTES. *Paeonia corsica* Sieber ex Tausch is characterised by having mostly 9 leaflets and leaves often rather densely villose beneath, carpels mostly hispidulous with the widest part above the middle and hairs only 1.5 mm long, remarkable styles, and diploidy. The species has often been confused with *P. mascula*, *P. coriacea* and *P. cambessedesii*. In *P. mascula*, there are usually more than ten, rarely nine, leaflets/leaf segments, which are usually glabrous or sparsely hispid beneath (subsp. *russoi* is usually rather densely hispid); the hairs on carpels are much longer (3 mm) than those of *P. coriacea*, and there are no styles. *P. coriacea* is usually glabrous throughout except for a few variants, and it also has more than 10 leaflets/leaf segments.

Furthermore, *P. mascula* and *P. coriacea* are both tetraploid. *P. cambessedesii* is a diploid, with carrot-shaped roots and leaflets that are never segmented; indeed, it is closely related to *P. corsica*. However, *P. cambessedesii* is entirely glabrous throughout, mostly with 4–6 carpels, and its leaflets are never segmented and sometimes reduced to 8 or even 7 in number, which is unique in the whole genus. *Paeonia corsica* has a relatively high number of sepals (3–5), nearly half of which (1, 2 or even 3) are acute at the apex. This character state can also be used to distinguish this species from its allies. Hong and Wang (2006: tab. 1, figs 2, 3 and 4) describe observations and statistical analysis which show that *P. corsica* is distinct from *P. mascula* (including subsp. *russoi*), *P. cambessedesii* and *P. coriacea*.

There are two questions concerning the taxonomy of the peony in Corsica and Sardinia: one is why *Paeonia corsica* Sieber ex Tausch, a valid name, has been neglected, and the other is why so many scientific names are used for the peony there. Seven taxa from Corsica and one from Sardinia have been described as new.

Paeonia corsica Sieber ex Tausch (1828) was described as new on the basis of a collection from Mt Cagna, Corsica. The protologue states, “*germinibus glabris erectis; foliis biternatis, segmentis integris ovatis acuminatis subglaberrimis*” (carpels glabrous, erect; leaves biternate, segments entire, ovate, acuminate and nearly glabrous). This peony with “glabrous carpels” and “leaves..... nearly glabrous” was then variously treated in taxonomy. Cosson (1850) described this form as a new variety, *P. corallina* var. *leiocarpa* Coss., ignoring *P. corsica*, but he later treated it as a variety, *P. corallina* var. *corsica* (Sieber ex Tausch) Coss. (Cosson, 1887). *Paeonia corsica* was neglected by Lynch (1890). Huth (1891) recognised this form as *P. corallina* var. *cambessedesii* Willk. (1875), and treated *P. corsica* as its synonym. Willkomm’s variety was originally described from the Balears, Spain. Rouy and Foucaud (1893) treated it as a form, *P. corallina* f. *corsica*. Fiori (1898) recognised it at varietal rank but under a different specific name, *P. officinalis* subsp. *corallina* var. *corsica*. Gürke (1903) recognised this plant as *P. mascula* var. *corsica*. Ascherson and Graebner (1923) restored *P. corallina* var. *corsica* (Sieber ex Tausch) Coss. (1887), and treated *P. corallina* var. *leiocarpa* and *P. cambessedesii* as its synonyms. In his monograph of *Paeonia*, Stern (1946) treated all the names with “*corsica*” as synonyms of *P. russoi* var. *leiocarpa*. Following Stern (1946), no later author, except for Halda (2004), recognised “*corsica*” as a valid name at any rank. For



Map 5.17. Distribution of *Paeonia corsica* Sieber ex Tausch.

Fig. 5.17A (opposite). *Paeonia corsica* Sieber ex Tausch: **a**, the lower part of the plant, showing carrot-shaped roots, caudex and scales at the base of the stem; **b**, the upper part of the plant and a flower with petals and stamens shed, showing disk and carpels; **c**, a lower leaf; **d**, the lower surface of a leaf, showing holosericeous hairs. Drawn by Miss LI Ai-Li.



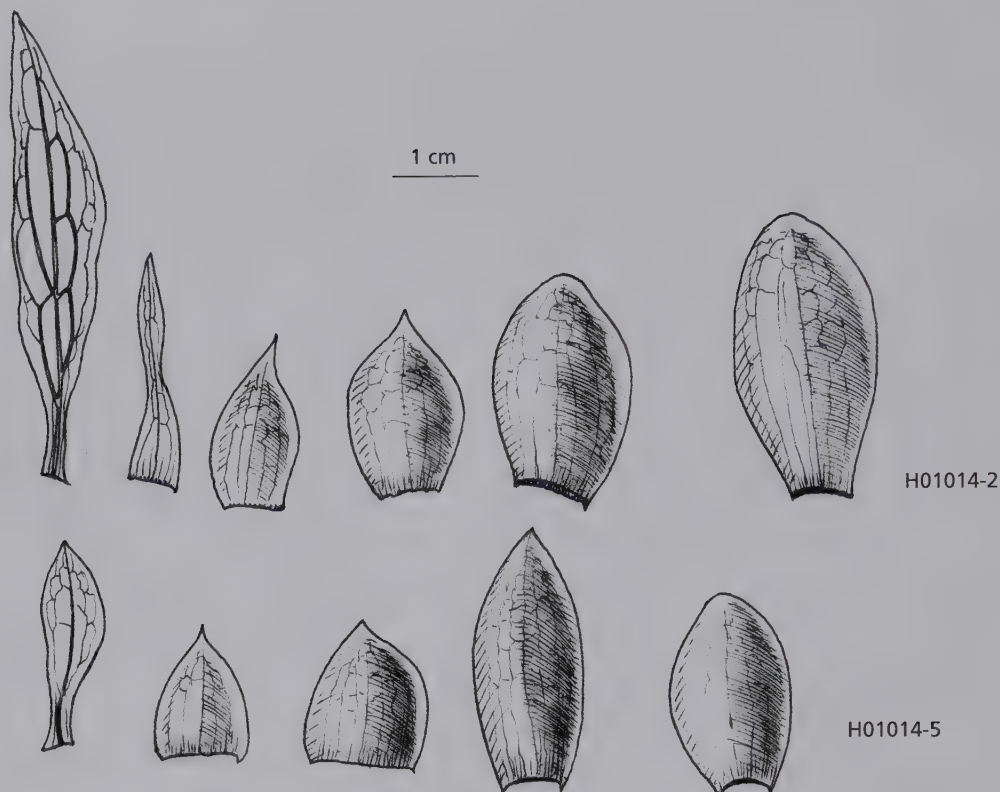


Fig. 5.17B. *Paeonia corsica* Sieber ex Tausch: involucrate bracts and sepals, based on D. Y. Hong, X. Q. Wang & A. Fridlender H01014-2 and H01014-5 (A, CAS, K, MO, PE, UPA). Drawn by Mr SUN Yin-Bao.

example, Zángheri (1976) identified Sieber's form in Sardinia as *P. coriacea* Boiss. (1838), which was originally described from southern Spain, without mentioning *P. corsica*; Pignatti (1982) identified Sieber's peony as *P. coriacea*, treating *P. corsica* as its synonym, and this treatment was followed by Schmitt (1997). Akeroyd (1993) treated *P. corsica* as a synonym of *P. mascula* subsp. *russoi*. Halda (2004), following Huth (1891), put *P. corsica* and *P. cambessedesii* into a single species, but he used the former name. Thus, Sieber's peony has been given three ranks, specific, varietal and form, with various names. The name *P. corsica* has been neglected by most recent authors who dealt with *Paeonia* in the region, e.g. Cullen and Heywood (1964a, 1964b), Schmitt (1997).

The peony in Corsica and Sardinia has been found to be extremely variable, particularly in the population D. Y. Hong *et al.* H01015 (A, BM, CAS, K, MO, PE, UPA) from Cagna, Corsica, the type locality of *P. corsica*. Here leaflets/leaf segments were found to be 9, 10, 12, 13, 16 and 20 in number, and glabrous or sparsely to rather densely hairy beneath; carpels were found to number from one continuously to eight, and to be holosericeous, rarely glabrous. Our field observations and population sampling have shown that such variations are actually polymorphic (Hong & Wang, 2006: tabs. 1 and 2). Reverchon's two collections, *Reverchon* 218 from S Corsica and *Reverchon* 291 from N Sardinia, both have a number of duplicates. Our examination of them also showed polymorphic features of the peony on these two islands (Hong & Wang, 2006). *Reverchon* 291 was collected from Mt Limbaro, N Sardinia, twice in May and July of 1882, and has a number of duplicates in the herbaria E, K, P and WU. One sheet in Kew (K) is of two individuals, one (collected in May) with three hairy carpels and the other (July) with four glabrous carpels, but both individuals have nine leaflets that are hairy beneath. The two individuals at Edinburgh (E) both

have three hairy carpels and nine hairy leaflets; and the two in Vienna (WU) have five hairy carpels and hairy leaflets. There are four sheets in Paris (P), among which leaflet/leaf segment number varies from 9 to 11, all individuals are rather densely hairy beneath. On one sheet the individual possesses two carpels that are densely hispidulous; another has an individual that is sparsely hairy near the styles and along the sutures; whereas the specimens on the other two sheets have entirely glabrous carpels. The fact that some specimens “possess *mascula*-like fruits”, whereas the others “have *coriacea*-like fruits” has caused some difficulties in taxonomy, as recognised by Cullen and Heywood (1964a), who even doubted whether Reverchon’s collection (Reverchon 291) came from the same place. The number of leaflets/leaf segments and the presence or absence of indumentum on the lower surface of leaves and on carpels are variable even within populations, e.g. *D. Y. Hong et al.* H01015, and these characters are not correlated with each other or with any other character. Therefore, the peony on Corsica and Sardinia is highly polymorphic, and cannot be considered to comprise more than one entity.

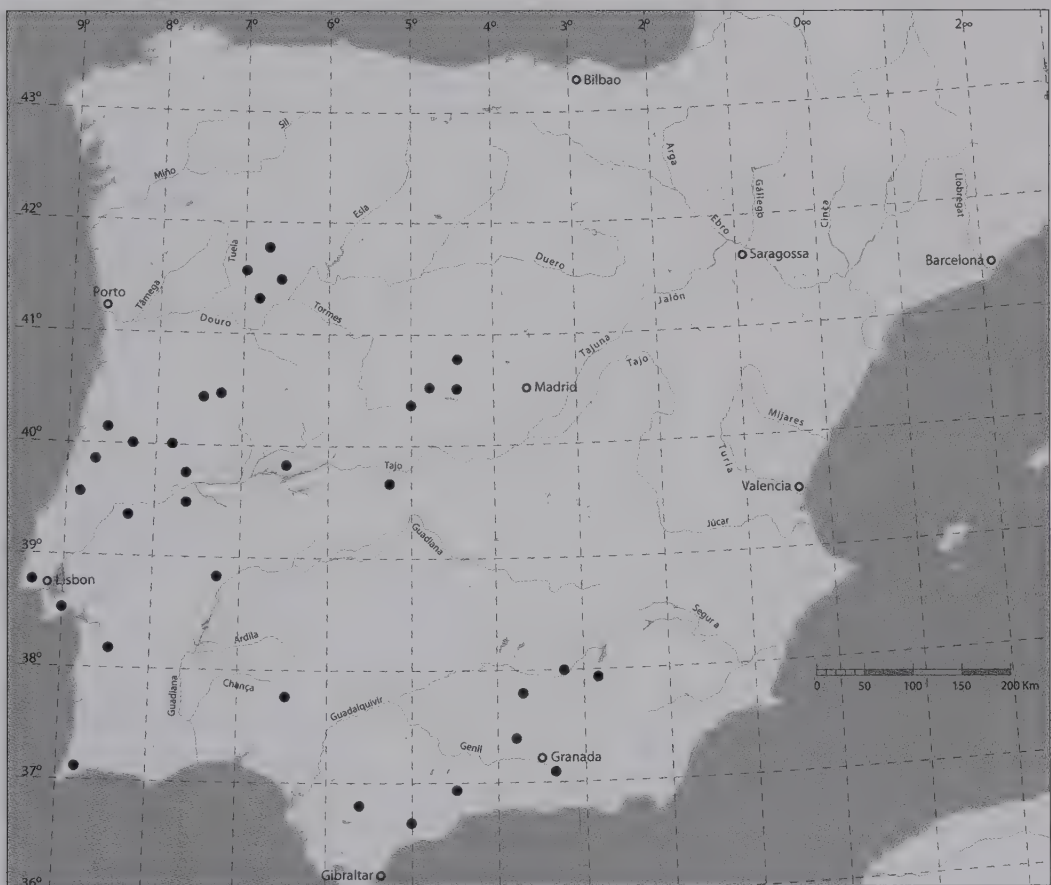
The peony from Lefkada, Zakynthos, Kefallonia and Akarnania, W Greece, was found to be similar to that in Corsica and Sardinia, but it differs in morphology from that in Sicily. It is a diploid with $2n = 10$, like the peony in Corsica and Sardinia. Therefore, the peony in W Greece is the same entity as that in Corsica and Sardinia, but differs from that in Sicily, as recognised by Tzanoudakis (1977) and by Stearn and Davis (1984).

Sieber’s peony is not the only form of *Paeonia* in Corsica and Sardinia. A number of other forms have been described and variously treated. A form with leaves villose beneath and carpels hispidulous was described as a new variety from Corsica by Moris (1837), *P. corallina* var. *pubescens*. This entity was reduced by Cosson (1887) to synonymy with *P. corallina* var. *russoi* (Biv.) Coss. (= *P. russoi* Biv.). *Paeonia russoi* Biv. (Bivona, 1816) was originally described on the basis of a plant from Panorm, Sicily. It is characterised by leaves “*supra glabris, subtus vix pubescentibus*”, carpels “*duo, recurvatae, pilose*”, and “*petala 6, obovata, chermisia*” (leaves “glabrous above, more or less pubescent beneath”, carpels “two, recurved, pilose”, and “petals 6, obovate, red”). Huth (1891) identified a peony in Corsica and Sardinia with pubescent leaves and glabrescent carpels when mature as *P. corallina* var. *russoi*. Rouy and Foucaud (1893) recognised a form with glabrous or pubescent leaves and tomentose carpels as *P. corallina* f. *ovatifolia* (Boiss. & Reut.) Rouy & Foucaud (= *P. broteri* var. *ovatifolia* Boiss. & Reut.), and a form with usually pubescent leaves and tomentose carpels as *P. corallina* f. *triternata*. *Paeonia broteri* var. *ovatifolia* Boiss. & Reut. was originally described from Spain by Boissier and Reuter (1842); the type locality of *P. triternata* Pall. is Crimea, Ukraine. A form with another combination of characters, i.e. carpels glabrous but leaves pubescent, was described as a new variety from Corsica by Legrand (1899), *P. russoi* var. *reverchonii* Legrand. Also from Corsica, Jordan (in Jordan & Fourreau, 1903) described two new species: *P. revelieri* with its leaves pubescent beneath and red along nerves and carpels tomentose, and *P. glabrescens* with its leaves polished and carpels 3–7 in number, tomentose. Again from Corsica, Briquet (1910) described a new taxon with leaves glabrescent, *P. corallina* var. *pubescens* f. *hypoleuca*. Interestingly, with so many botanic names available for *Paeonia* in Corsica and Sardinia, Cesca and his co-workers (Cesca *et al.*, 2001) described another new species from Sardinia, *P. morisii*, which is characterised by purplish stems, almost always 9 leaflets and long, irregularly bent and abundant hairs on the lower surface.

Five infraspecific taxa were recognised by Ascherson and Graebner (1923) for the peony in Corsica and Sardinia. If Jordan’s two species, which were not mentioned by Ascherson and Graebner (1923), are taken into consideration, the number of taxa in Corsica and Sardinia would be seven in three species. At the other extreme, only one taxon, *P. mascula* subsp. *russoi*, was recognised by Cullen and Heywood (1964a, 1964b) in the whole region under study. Therefore, the number of taxa recognised in Corsica and Sardinia changed from seven (Ascherson & Graebner, 1923) to one (Cullen & Heywood, 1964a, 1964b). The total number of botanic names used for *Paeonia* in Corsica and Sardinia is as great as 29.

ADDITIONAL SPECIMENS EXAMINED. FRANCE, CORSICA, near **Ajaccio**, 1850, *Requien* s.n. (G); *s. loc.*, 1846, *Bernard* 112 (G); *s. loc.*, June 1884, *T. Hubler* s.n. (K); *s. loc.*, 1866, *P. Mabile* 102 (P). **Mt Cagna**: between Punta di Compoletti and Punta di Litia, granites, 850–900 m, 31 May 2001, *D. Y. Hong, X. Q. Wang & A. Fridlender* H01015 (A, BM, CAS, K, MO, PE, UPA); *loc. eodem*, 13 July 1910, *J. Stefani* s.n. (P); *loc. eodem*, 13 July 1911, *J. Stefani* s.n. (W); *loc. eodem*, May 1919, *J. Stefani* s.n. (P); *loc. eodem*, 1,200 m, June 1917, *P. Cousturier* s.n. (K); *loc. eodem*, Bomfari, June 1918, *P. Cousturier* s.n. (G, P); *loc. eodem*, Bomfari, 800 m, May 1937, *G. Desplantes* s.n. (GZU, WU). **Corte-Soveria**: 1849, *Requien* s.n. (G); *loc. eodem*, 22 Apr. 1912, *N. Roux* 545 (B, P); Corte, 2 May 1869, *O. Debeaux* s.n. (BM); Corte, 700 m, 5 May 1878, *Ch. Burnouf* s.n. (WU). **Foret de Perticato**: 1822, *Requien* s.n. (G); *loc. eodem*, 15 May 1869, *Soleirol* s.n. (G); *loc. eodem*, June 1827, *Requien* s.n. (K); *loc. eodem*, July 1835, *Carrien* s.n. (G). **Galeria**: Capo dia Media, 930 m, among *Pteridium aquilinum*, 29 May 2001, *D. Y. Hong, X. Q. Wang & A. Fridlender* H01014 (A, BM, CAS, K, MO, PE, UPA); *loc. eodem*, Capo Manganello, 900 m, among *Pteridium aquilinum*, 29 May 2001, *D. Y. Hong, X. Q. Wang & A. Fridlender* H01013 (MO, PE). Near **Levie**, c. 450 m, Apr. 1933, *D. Alice & C. & E. Godman* s.n. (BM). **Olmi-Capella**, 20 Apr. 1866, *C. de Marsilly* s.n. (BM, G, K); Palasca Olmi-Capella, 700 m, May 1917, *P. Cousturier* s.n. (G). **Serra di Scopamene**, near Sartene, 2 June 1879, *E. Reverchon* 218b (F, K, P, WU). **Tavignano**, 1843, *Bernard* 80 (G). **Vizzavone**, 14 June 1917, *C. I. Forsyth-Major* s.n. (K). **Zonza**: Rocailles, granites, 1,100 m, May 1937, *G. Desplantes* s.n. (B); Zonza, Lececia, Rocailles, May 1934, *G. Desplantes* s.n. (B); *loc. eodem*, 4 June 1879, *P. Tillet* s.n. (G). **GREECE, ETOLIA**: Akarnania Distr., Vonista/Xiromeros, Akarnanika Mts, S of Komboti Village, Boumistos summit, deciduous forests, 700–1,000 m, 11 May 1974, *E. Stamatiadou* 17845 (ATH); Akarnania, Skourtou, near a monastery, 450 m, along ridge, limestones, *Quercus* communities, 26 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & D. Tzanoudakis* H02225 (A, K, MO, PE). **KEFALLONIA**: Kranea, Mt Giupari, NNW slopes, limestones, maquis and *Abies cephalonica* forests, 800–1,000 m, 1 Apr. 1982, *E. Stamatiadou* 22668 (ATH); Mt Enos, SW side of Roudhi summit, 700–800 m, between maquis and *Abies cephalonica* forests, 29 Apr. 1974, *E. Stamatiadou* 17797 (ATH, BM); Mt Enos, 1 May 1934, *F. Guiol* 2368 (BM). **LEFKADA**: Hortata, E side of the village, Strongilo, 900 m, rocky slopes with low shrubs, limestones, 16 Apr. 1970, *E. Stamatiadou* 8113 (ATH, BM); *loc. eodem*, ENE of the village, W rocky slopes with *Quercus coccifera*, *Crataegus* and *Phlomis fruticosa*, 20 Apr. 1977, *E. Stamatiadou* 19652 (ATH, BM). **ZAKINTHOS**: Orthonies Village, S of Spileotissis Monastery, 400 m, limestones, rocky fields with *Phrygana* and shrubs, 20 Mar. 1976, *E. Stamatiadou* 18809 (ATH, BM, E); *loc. eodem*, 450–500 m, 13 Mar. 1971, *Merkatis* 10980 (ATH, BM); Mt Vrachionas, near Gyri Village, 600 m, 15 May 1974, *D. Tzanoudakis* 1365 (GZU); *loc. eodem*, 600 m, 1 Apr. 1980, *M. Young* H-627 (K). **ITALY, SARDINIA**: Mt Limbardo, Arrondissement de Tempio, 16 May 1882, *E. Reverchon* 291a (E, K, P, WU); *loc. eodem*, 14 July 1882, *E. Reverchon* 291b (E, K, P, WU); Di Sassari, Fiorentinodictu Copiosa, 600–700 m, 10 May 1914, *A. Fiori & S. Tiana* s.n. (BM, K, RO); *loc. eodem*, 600–700 m, 24 May 1912, *A. Fiori & S. Tiana* 1853 (BM, K, RO, WU); Laconi, 9 Apr. 1974, *M. Nydegger* s.n. (LD); Nuoro, above Oliena, mountain summit, limestones, 1,230 m, 2 June 2001, *D. Y. Hong, X. Q. Wang & A. Fridlender* H01016 (A, CAS, K, MO, PE); Mt Oliena, 12 May 1884, *F. Major* s.n. (WU); Nuoro, Barbagia, Mt Arcueri, 950–1,080 m, 3 May 1986, *J. Poelt & Ch. Scheuer* s.n. (GZU); Nuoro, Mt Strabe, c. 950 m, 22 May 1985, *P. L. Nimi & J. Poelt* s.n. (GZU); Nuoro, Gennargentu Range, Mt Tonneri, limestones, 950–1,000 m, 3 June 2001, *D. Y. Hong, X. Q. Wang & A. Fridlender* H01018 (A, BM, CAS, K, MO, PE, UPA); Nuoro, Mt Gennargentu, 1,570–1,700 m, 27 May 1983, *A. Charpin et al.* AC 17795 (E, G); near Pula, Apr. 1928, *U. I. Müller* s.n. (E, G, K); Central Sardinia, 3 July 1971, *G. Dunford & E. G. Moyes* 137 (BM); *loc. eodem*, 1830, *Moris* s.n. (G); *loc. eodem*, 1839, *Moris* s.n. (G).

18. *Paeonia broteri* Boiss. & Reut., *Diagn. pl. nov. Hisp.*, 4 (1842) nom. cons. (Brummitt, *Taxon* 56(2): 591 (2007)); Boissier, *Voy. bot. Espagne* 1: 714 (1845); Willkomm in Willkomm & Lange, *Prodr. fl. hispan.* 3: 975 (1880); Baker in *Gard. Chron.* n. ser. 22: 10 (1884); in *ibid.* 24: 48, fig. 11 (1886); Lynch, *J. Roy. Hort. Soc.* 12: 436 (1890); Sampaio, *Prodr. Fl. Port.* (in *Ann. Sci. Acad. Polytechn. Porto*, 4–6:) 8 (1911), (pro syn. sub *P. mascula* rac. *lusitanica*); Stern, *J. Roy. Hort. Soc.* 56: 72 (1931), in *ibid.*, 68: 127 (1943); Stern, *Study Gen. Paeonia*, 86–87, cum tab. (1946); Cullen & Heywood in Tutin *et al.* (eds), *Fl. Europ.* 1: 243 (1964); Akeroyd in Tutin *et al.* (eds), *Fl. Europ.* edn 2, 1: 293 (1993); Muñoz-Garmendia & Navarro in Castroviejo *et al.* (eds), *Fl. Iberica* 3: 146 (1993); Hong & Castroviejo in *Taxon* 54(1): 211 (2005). *Paeonia corallina* Retz. var. *broteri* (Boiss. & Reut.) Coss., *Comp. fl. atlant.* 2: 53 (1887); Huth, *Bot. Jahrb. Syst.* 14: 267 (1891). *Paeonia mascula* (L.) Mill. var. *broteri* (Boiss. & Reut.) Gürke in Richter (ed.), *Pl. eur.* 2(3): 401 (1903). TYPE: “*Paeonia* nov. sp.? Colmenar viejo, Choras (Chozas) & Miraflores, in dumetis, 14.15.16. mai 1841”, Reuter s.n. (lectotype designated by Burdet *et al.*, 1988, G!; isoelectotypes BM! G! K!). *Paeonia lusitanica* Mill., *Gard. dict.* edn 8, No. 6 (1768), nom. rej. (Brummitt, 2007); Tausch in *Flora* 11(1): 86 (1828); Sampaio, *Fl. port.* edn 2, 219, 741 (1946). *Paeonia mascula* (L.) Mill. var. *lusitanica* (Mill.) Samp., *Prodr. Fl. Port.* (in *Ann. Sci. Acad. Polytechn. Porto*, 4–6:) 8 (1911). *Paeonia officinalis* L. var. *lusitanica* (Mill.) Martyn in Miller, *Gard. dict.* edn 9, 2(1): No. 2 (1807). TYPE: Spain, Madrid, Sierra de Guadarrama, El Escorial, La Herreria, 30 TVK 0309, 700 m, 2 June 2004, Carrasco *et al.* 17437SC (neotype MA No. 714084!; isoneotypes BM, G, K, PE!).



Map 5.18. Distribution of *Paeonia broteri* Boiss. & Reut.

Paeonia broteri Boiss. & Reut. var. *ovatifolia* Boiss. & Reut., *Diagn. pl. nov. Hispan.*, 4 (1842). *Paeonia lusitanica* Mill. var. *ovatifolia* (Boiss. & Reut.) Samp., *Herbário Português*, 53 (1913). *Paeonia mascula* (L.) Mill. var. *ovatifolia* (Boiss. & Reut.) Gürke in Richter (ed.), *Pl. eur.* 2(3): 401 (1903), pro parte, excl. pl. Cors. & Sicil. *Paeonia mascula* (L.) Mill. var. *broteri* (Boiss. & Reut.) Gürke f. *ovatifolia* (Boiss. & Reut.) Cout., *Fl. Portugal*, 240 (1913). *Paeonia corallina* Retz. var. *broteri* (Boiss. & Reut.) Coss. f. *ovatifolia* (Boiss. & Reut.) Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 551 (1923), pro parte, excl. Cors. & Sicil. TYPE: Spain, Granada, "in omnibus montibus regni Granatensis" alt. 910–1,840 m, June 1837, E. Boissier s.n. (lectotype designated by Burdet *et al.* 1988, G!; isolectotype G!).

Paeonia lobata Desf., *Tabl. école bot.* 126 (1804), nom. nud.

Paeonia lobata Desf. ex DC., *Syst. nat.* 1: 391 (1818), pro parte, quoad pl. Lusit. and *Prodr.* 1: 66 (1824), pro parte, quoad destrub., nom. illeg.

Paeonia officinalis L. var. *lobata* (Desf.) Webb, *Iter hispan.*, 80 (1838), nom. nud.

Paeonia lobata Desf. ex Boiss., *Voy. bot. Espagne* 1: 14 (1839) and 714 (1845). TYPE: not designated.

Perennials. Tap roots carrot-shaped, up to 3 cm in diameter, lateral roots thin and basipetally attenuate. Stems usually purple, less frequently green, glabrous, 30–80 cm tall. Lower leaves biternate, usually most or nearly all leaflets segmented; leaflets/leaf segments 11–32, but mostly 15–21 in number, elliptic or ovate-lanceolate, rarely obovate, 4–10 (15) cm long, 1.5–5(6.5) cm wide, cuneate at the base, acute or short-acuminate at the apex, glabrous on both sides, very occasionally sparsely puberulous beneath. Flowers solitary and terminal; involucre bracts 2 or 1 in number, leaf-like, or very rarely absent; sepals usually 3, rarely 4 in number, mostly rounded at the apex, up to 3 cm long, 2.6 cm wide, green but purple at the periphery, glabrous, very occasionally puberulous on the abaxial side; petals 6–7 in number, pink-red, 5–6 cm long, 3–4 cm wide; filaments yellow or purple; anthers yellow; disk waved, 2 mm high, glabrous or tomentose; carpels mostly 2 or 3, less frequently 1 or 4, very occasionally 5 in number, tomentose, hairs 2 mm long, rust-brown; stigmas sessile, red, 2.5 mm wide. Follicles 2.5–4 cm long, 1.3–1.6 cm in diameter. Seeds oblong, black, 7–8 mm long, 5–6 mm wide. Figs 5.18A, 5.18B.

PHENOLOGY. Flowering from April to early June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (Queiros, 1995; Stebbins, 1938a; Stern, 1944; the present work with the voucher: Spain, Avila, D. Y. Hong & P. Vargos H03015 (A, BM, CAS, K, MO, P, PE)).

HABITAT AND DISTRIBUTION. Growing in shrubs, oak or pine forests, in limestone soils at altitudes from 300 to 1,830 m. Confined to the Iberian Peninsula (Spain and Portugal) (Map 5.18). (We saw two collections from Morocco on a sheet in the Botanical Museum, University of Lund, Sweden (LD). One is from Mt (Djebel) Hassen, 1910–1911, *M. Gandoger* s.n. and the other from Mt Onezzan, 1910–1911, *M. Gandoger* s.n. According to Dr G. Dahlgren (personal communication), the field records of Gandoger's collections were often mixed up.)

DIAGNOSTIC CHARACTERS. *Paeonia broteri* is characterised by plants glabrous throughout except carpels, leaflets or segments relatively narrow with a relatively high number. The species is closely related to *P. clusii*, and their relationship is discussed under that species. *Paeonia broteri* also resembles *P. coriacea* and *P. mascula* to some extent, but differs from the former in having tomentose carpels and narrower leaflets/leaf segments (1.5–5(6.5) rather than 2–8 cm wide), and from the latter in having more leaflets or segments (11–32 rather than 10–18–(21)), which are smaller (4–10(15) × 1.5–5(6.5) cm rather than 4.5–18 × 3–9 cm) and nearly always glabrous, and shorter hairs on carpels (2 mm rather than 3 mm long). Furthermore, *P. broteri* is a diploid ($2n = 10$), whereas *P. coriacea* and *P. mascula* are tetraploid ($2n = 20$). We found *P. broteri* and *P. coriacea* coexisting in the Alfacar Mountains, NE of Granada, but they appeared distinct.

Fig. 5.18A (opposite). *Paeonia broteri* Boiss. & Reut.: **a**, carrot-shaped roots (drawn by Miss LI Ai-Li); **b**, caudex and the lower part of the stem; **c**, a lower leaf; **d**, the upper part of the stem; **e**, a flower with petals and stamens shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.



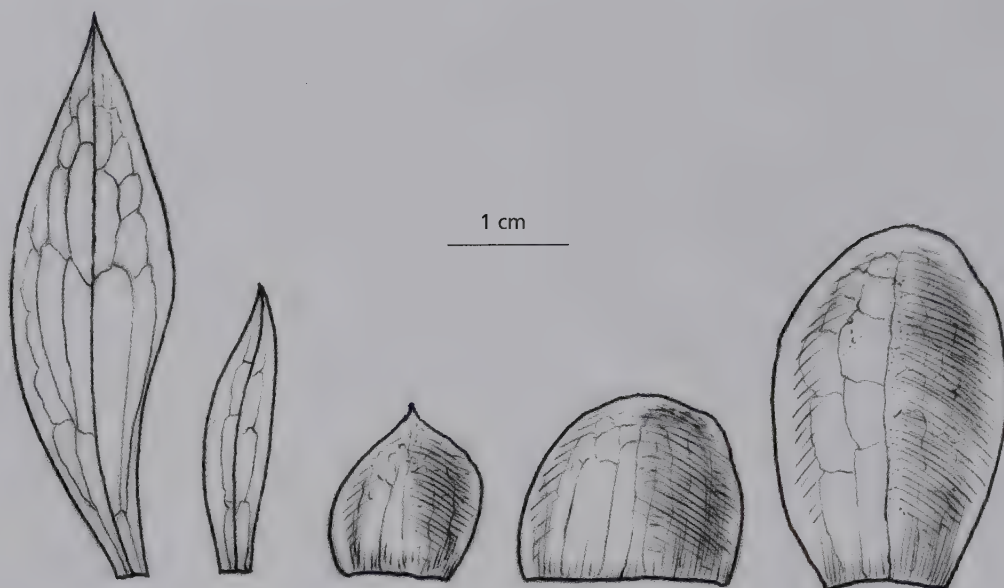


Fig. 5.18B. *Paeonia broteri* Boiss & Reut.: involucrate bracts and sepals, based on D. Y. Hong & P. Vargos H03015 (A, BM, CAS, K, MO, PE). Drawn by Mr SUN Yin-Bao.

ADDITIONAL SPECIMENS EXAMINED. PORTUGAL: *s. loc.*, Welwitsch 18 (COI); Rocha da Pena, near de Salir, 21 Mar. 1967, J. Paiva 172 (COI). **ALENTEJO:** Vila Vicosa, 28 Apr. 1973, Ladero, Rivas Goday & E. Valdes s.n. (MA); Vila Viçosa, Tapada Real, Mt das Pedras, 5 May 1947, A. Fernandes & F. Sousa 1612 (COI); Vila Viçosa, Tapada Real, 5 May 1947, A. Fernandes & F. Sousa 1586 (COI); *loc. eodem*, 9 May 1947, A. Fernandes & F. Sousa 1915 (COI); Hortas, Sierra de Grândola, 12 Apr. 1949, R. Fernandes & F. Sousa 3939 (COI, K). **ALGARVE:** Sierra de Monchique, Foia, 4 May 1951, A. Fernandes, R. Fernandes & Y. Matos 3637 (BM, COI); *loc. eodem*, 24 May 1938, W. Rothmalor s.n. (B); Sierra de Monchique, summit, 2 June 1853, E. Bourgeau 1755 (BM, K); Sierra de Monchique, 25 Apr. 1957, Malato-Beliz et al. 3115 (COI, GZU); *loc. eodem*, 22 Apr. 1968, Malato-Beliz et al. 5897 (MA); *loc. eodem*, 2 June 1853, E. Bourgeau s.n. (K, W); *loc. eodem*, Apr. 1886, J. Daveau s.n. (COI); *loc. eodem*, 300 m, *Quercus spinosa* scrubs, 7 May 1976, M. Gibby & A. C. Jemz 12607 (BM); *loc. eodem*, 900 m, 22 Apr. 1968, O. de Botis s.n. (BC); Sierra de Arrabida, 31 Mar. 1908, S. R. Chodat 712 (G); *loc. eodem*, 17 Apr. 1951, H. Kaim s.n. (COI); *loc. eodem*, Apr. 1885, J. Daveau s.n. (G); Arrabida, Rasca, Mar. 1877, J. Daveau s.n. (BM); Vila do Bispo, Praia do Castelejo, 12 Mar. 1953, C. Roraris & E. J. Mendes 812/1060 (COI). **BEIRA ALTA:** E of Guarda, to Vilar Formoso, 19 Apr. 1952, A. Fernandes, F. Sousa & Y. Matos 4000 (BM, COI); near Guarda, do Bispo, 17 June 1949, R. Fernandes & F. Sousa 3463 (COI); Guarda, Santo do Bispo, 23 Apr. 1952, A. Fernandes, F. Sousa & Y. Matos 4144 (COI). **BEIRA BAIXA:** Castello de Vide, 9 June 1962, A. & R. Fernandes & Y. Matos 8600 (COI); Castelo de Vide, Santo António, 27 Mar. 1961, A. Fernandes, Y. Matos & F. Cardoso 7748 (COI); Pampilhosa da Serra, Vale de Castanheira, 27 Mar. 1956, A. Antonio & R. Brita s.n. (COI); Pombal, Mt Sico, 550 m, July 1885, J. Daveau s.n. (COI); Castello Branco, June 1882, A. R. da Cunha 125 (COI). **BEIRA LITORAL:** Coimbra, Eiras, May 1886, A. J. Moller 200 (BM, COI, RO, WU); *loc. eodem*, Apr. 1879, A. J. Moller s.n. (BM); *loc. eodem*, May 1887, J. A. A. Castro s.n. (WU); Coimbra, 1877, F. Brotero de Avellar 48 (WU); Coimbra, Ansiao, 15 Apr. 1987, A. Moura 3113 (MA); Coimbra, Condeixa, c. 300 m, 7 June 1989, N. M. Samaniego s.n. (COI); Junto, Estremadura, 20 May 1908, R. P. Murray s.n. (BM, GZU). **ESTREMADURA:** Sintra, between Colares and Almocegeme, May 1903, A. R.

Jorge s.n. (COI); entre Porte de Mos e Mira de Aire, calcario, 22 Apr. 1966, *A. & R. Fernandes & J. Paiva* 9468 (COI). **RIBATEJO**, Rossio ao Sul do Tejo, 20 Apr. 1978, *P. Cubas et al.* 007 MG (MA). **TRAS-OS-MONTES**: Peredos, 41°26'N, 6°46'E, 350 m, 14 Apr. 2001, *C. Aedo* s.n. (MA); Mirandela, 22 Apr. 1955, *Malato-Beliz et al.* 1961 (COI); Bragança, June 1884, *A. Moller* s.n. (COI); Bragança, Caminho de Avelauoso, 16 Aug. 1945, *A. Prudeucishha* 22 (COI); Vimioso, Pedreiras de Santo Adrião, 15 June 1858, *A. & R. Fernandes & Y. Matos* 6445 (COI). **SPAIN**, **ALBACETE**, Sierra de Alcaraz, 1,250 m, 24 May 1993, *Castroviejo, Casaseca & Carrasco* 12665 SC (MA). **AVILA**: Mingorria, 10 Aug. 2003, *D. Y. Hong & P. Vargos* H03015 (A, BM, CAS, K, MO, P, PE); Sierra de Gredos, 17 Aug. 1878, *E. Levier* s.n. (G, GZU); 28 June 1927, *A. J. Wilmott* s.n. (BM); Sierra de Gredos, 22 July 1863, *E. Bourgeau* s.n. (BM); Sierra de Gredos, El Arenal, pine woods, 1,200 m, 24 July 1956, *Deverall & Flannigan* 0409 (E); Hoyocasero, 1,200 m, *Pinus sylvestris* forests, 10 Aug. 2003, *D. Y. Hong & P. Vargos* H03017 (PE); Valle del rio Corneja, 27 July 1984, *J. Estrada* s.n. (MA). **CÁDIZ**: Grazalema, Sierra del Endrinal, 21 Apr. 1962, *B. Casaseca* s.n. (MA); Sierra de Grazalema, 500 m, limestones, forests, 20 May 1890, *E. Reverchon* 539a (B, E, G, GZU, P); *loc. eodem*, 15 July 1890, *E. Reverchon* 539b (P); *loc. eodem*, 15 June 1890, *E. Reverchon* s.n. (G, WU); Baetica, above Grazalema, 2 Jan. 1925, *Font Quer* s.n. (BC). **CIUDAD-REAL**, Valle del Rio Tobar, 4 May 1933, *G. Albo* s.n. (MA). **GRANADA**: Puebla de Don Fadrique, 19 June 1894, *St.-Lager* s.n. (K); Sierra de Alfacar, in pine woods, 12 Aug. 2003, *D. Y. Hong & A. Quintanar* H03019 (MO, PE); Sierra Nevada, 10 June 1926, *A. J. Wilmott & T. A. Lofthouse* s.n. (BM); *loc. eodem*, 24 July 1926, *H. Lindberg* 1220 (K); *loc. eodem*, 990 m, limestones, among *Crataegus monogyna*, 3 July 1953, *Halliwell, Mason & Smallcombe* 1087 (K); *loc. eodem*, 1,520–1,830 m, 26 June 1951, *J. Ball* s.n. (K); *s. loc.*, 910–1,830 m, June 1837, *R. J. Shuttleworth* s.n. (BM); Sierra Nevada, above Hojabije, 10 July 1948, *V. H. Heywood & P. H. Davis* 605 (BM); Sierra Nevada, Güejar, 15 May 1950, *Munoz Medina* s.n. (BC); above Cajar, 1,400 m, 14 July 1948, *V. H. Heywood & P. H. Davis* 779 (BM, E); Sierra de la Sagra, 1,600 m, June 1900, *E. Reverchon* s.n. (B, E, G, GZU, P, WU); Sierra de Alfazac, 22 July 1883, *N. H. Nilsson* s.n. (G). **HUELVA**: Puerto del Moral, 2 May 1975, *B. Cabezudo et al.* 1431/75 (MA); Sierra de Castano, 30 June 1942, *C. Vicioso*, s.n. (MA). **JAEN**: Alcaudete, N del Ahillo, Calizas, 1,000 m, 26 Apr. 1986, *C. Fernández & E. Gutiérrez Ureña* s.n. (MA); near Jaen, Sierra de la Pandera, 1,100 m, 27 May 1967, *I. K. Ferguson* 1697 (BA). **SIERRA MAGINA**: Puerto de la Mata, 1,600 m, 23 June 1925, *Cuatrecasas* s.n. (BC); *loc. eodem*, 19 Oct. 1925, *Cuatrecasas* s.n. (BC). **MANCHA REAL**, 800–1,000 m, 11 June 1987, *E. Dorda et al.* s.n. (MA). **SIERRA DE EL CAZORLA**: near San Pollo, 28 June 1948, *V. H. Heywood* 334 (BM); in woods, 26 June 1948, *V. H. Heywood & P. H. Davis* 164 (BM); Vertientes de Gilillo, 1,650 m, 12 July 1951, *V. H. Heywood* 1179 (BM); *loc. eodem*, 1,650 m, 12 July 1951, *V. H. Heywood* 1202 (BM); above Cerrado del Tejo, 1,520 m, 23 July 1951, *V. H. Heywood* 1537 (BM); Arroz de los Cierzos, 1,200 m, 22 July 1951, *V. H. Heywood* 1503 (BM); Barranco de los Valdeazorillos, 1,200 m, 26 July 1951, *V. H. Heywood* 1696 (BM); Barranco de Valentina, 1,700 m, June 1904, *E. Reverchon* s.n. (G); El Chorro-Laganillos, 1,300 m, 11 July 1951, *V. H. Heywood* 1135 (BM); Poyo Bajo El Pulpito, 1,230 m, 11 July 1951, *V. H. Heywood* 1175 (BM); Burunchel, Vadillo, 19 May 1973, *A. Polatschek* 67 (W); Cuerda de las Moras, Cueva de las Zamdros, 1,500 m, 21 July 1951, *V. H. Heywood* 1485 (BM). Sierra de Segura, 17 May 1850, *E. Bourgeau* s.n. (E, K); *loc. eodem*, 27 July 1850, *E. Bourgeau*, s.n. (E, K). Sierra de Segurena, Pontones, 1,500 m, limestones, 10 June 1982, *S. Pajaron* 1396 (MA). **MADRID**, Cretacico de Cerceda, 17 July 1981, *D. S. Mata* s.n. (GZU). Sierra de Guadarrama: June 1914, *C. Vicioso* s.n. (MA); *loc. eodem*, Cercedilla, July 1916, *C. Vicioso* s.n. (B); *loc. eodem*, Apr. 1913, *F. Beltran* 4 (B); *loc. eodem*, 7 June 1926, *T. A. Lofthouse* s.n. (BM); *loc. eodem*, 22 May 1922, *L. Heard* s.n. (BM); El Escorial, 1854, *E. Bourgeau* s.n. (BM); *loc. eodem*, 1922, *L. Heard* s.n. (BM); above Vimalha, stony hills, 18 Apr. 1889, *C. C. Lacaita* 5376 (BM). Sierra de Guadalupe, near Rio Guadalupeno, 28 May 1923, *C. C. Lacaita* 23-180 (BM). Castella, Pardo, Escorial, *M. P. Graells* s.n. (BM, K). Pardo, Escorial, *E. Bourgeau* s.n. (WU). Cerro

de Maihotte, near Escorial, 11 June 1876, *M. Winkler* s.n. (WU). Guadalix de la Sierra, 860 m, 19 May 1983, *F. G. Manzanque* s.n. (MA); Miraflores de la Sierra, 880 m, in forests, 19 May 1983, *F. G. Manzanque* s.n. (MA). **MÁLAGA**: Sierra de Ronda: 1,000 m, June 1890, *E. Reverchon* s.n. (B); *loc. eodem*, 13 May 1889, *E. Reverchon* s.n. (E); *loc. eodem*, 9 Aug. 1889, *E. Reverchon* s.n. (E); Sierra de Alibe, 500–800 m, 26 May 1895, *Porta & Rigo* 19 (WU); 1,070 m, Apr. 1957, *D. Brinton–Lee* 454 (BM); summit, c. 1,500 m, 6 May 1925, *C. C. Lacaita* 25–195 (BM); clearings of *Abies* forests, 1,200 m, 7 May 1964, *C. M. Stocken* 35964 (E); 1,100 m, 18 Apr. 1972, *P. E. Gibbs & E. Doninguer* D18 (E); Cruce de Igualaja, 6 May 1975, *Fuertes* s.n. (MA). Sierra de Tolox, *Crataegus* maquis, 1948, *V. H. Heywood & P. H. Davis* 851 (BM). Sierra de la Nieves, 1,000–1,100 m, 23 Apr. 1987, *A. Charpin* 20995 (G). Sierra Morena, Despenaperro, 20 May 1925, *C. C. Lacaita* 25–310 (BM). Sierra Chimenea, Antequera, 15 May 1931, *L. Ceballos* s.n. (MA). Antequera, El Torcal. 17 May 1883, *N. H. Nilsson* 735 (BM) and 22 July 1883, *N. H. Nilsson* 735b (BM); *loc. eodem*, 1877, *J. J. Roemer* s.n. (BM). **ANDALUSIA**, c. 1,000 m, 30 Apr. 1925, *C. C. Lacaita* 25–130 (BM). Sierra de Aracena, Valdezufre, Arroyo, 10 Mar. 1978, *J. Riverd* R320 (B). **MURCIA**: Sierra de Alcaraz, 1,000–1,400 m, June 1891, *Porta & Rigo* 343 (B, G, K, P, WU); Moratalla, Sierra de la Muela, 1,250 m, 24 Apr. 1997, *C. Aedo et al.* 1078 LA (MA). **SALAMANCA**, Cabeza de Fracmontanos, 6 May 1976, *J. Sanchez* s.n. (BAC). **TOLEDO**, Velada, 6 Apr. 1983, *R. Téllez* s.n. (MA). **ZAMORA**, Tabara, Monte Las Fuentes, 740 m, 25 May 1996, *B. Hernandez* s.n. (MA).

19. *Paeonia clusii* Stern, *Bot. Mag.* 162: tab. 9594 (1940); Stern, *J. Roy. Hort. Soc.* 68: 130 (1943) and *Study Gen. Paeonia*, 102 (1946); Cullen & Heywood in Tutin *et al.* (eds): *Fl. Europ.* 1: 243 (1964); Akeroyd in Tutin *et al.* (eds): *Fl. Europ.* edn 2, 1: 293 (1993); Schmitt, *Plant. Montag.* 12(187): 422 (1998). *Paeonia cretica* Tausch in *Flora* 11: 88 (1828), non *P. cretica* Sabine ex Lindley 1824 (= *P. arietina* G. Anderson, 1818). *Paeonia foeminea* Mill. var. *cretica* (Tausch) Gürke in Richter (ed.): *Fl. eur.* 2: 403 (1903), pro parte, quoad pl. Cret. *Paeonia officinalis* L. var. *cretica* (Tausch) Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 556 (1923). *Paeonia peregrina* Mill. var. *cretica* (Tausch) Huth, *Bot. Jahrb. Syst.* 14: 270 (1891). TYPE: Crete, “in montibus Sphakeoticis Cretae Sieber”, 1817, *Sieber* s.n. (holotype K!).

Paeonia arietina G. Anderson var. *oxoniensis* G. Anderson, *Trans. Linn. Soc. London* 12(1): 276 (1818). TYPE: not designated.

Paeonia arietina G. Anderson var. *carnea* DC., *Prodr.* 1: 66 (1824). TYPE: not designated.

Paeonia peregrina Mill. var. *glabra* Boiss., *Fl. orient.* 1: 97 (1867). *Paeonia officinalis* L. var. *glabra* (Boiss.) Hayek, *Prodr. Fl. Penins. Balcan.* 1 (in *Fedde Rep. Sp. Nov. Beih.* 30(1): 298 (1927)), pro parte, excl. syn. *P. cretica* Sabine. TYPE: Crete, Mt Lassithion, May 1846, *Heldreich* s.n. (holotype BM!; isotype P!).

Paeonia cretica DC., *Syst. nat.* 1: 394 (1818), non pro sp. accept.(?)

Paeonia peregrina auct. non Mill.: Raulin in *Descrip. Phys. Ile de Crete Bot.* 2: 702 (1869), pro parte, excl. syn.

Perennials totally glabrous except carpels and occasionally lower surface of leaves. Tap roots thickened, slightly tuberous, up to 2.5 cm in diameter, lateral roots carrot-shaped. Stems usually purple, 25–50 cm tall, with scales several, up to 9 at the base. Lower leaves biternate, all leaflets segmented; segments 23–95 in number, linear, lanceolate to ovate, 5–10 cm long, 0.5–4.5 cm wide, usually glabrous on both sides, rarely hispidulous beneath. Flowers solitary; involucre bracts 1–2 in number, leaf-like; sepals 3 or 4 in number, ovate-rounded, mostly rounded at the apex, purple at the periphery; petals 7 in number, white, orbicular, oblong or nearly rhomboid, 4–5 cm long, 2.5–4 cm wide; filaments purple; anthers yellow; disk flat, 0.5–1.0 mm high, tomentose; carpels 2–4, rarely 1 in number, tomentose, hairs 2.0–2.5 mm long, pink or brown-yellow; styles 1–2 mm long; stigmas red, 1.5–2 mm wide. Follicles ellipsoid, 3.8 cm long, 1.5 cm in diameter, reflexed when mature. Seeds ovoid-spherical, black, 8 mm long, 5 mm in diameter. Figs 5.19 A, 5.19B.

CHROMOSOME NUMBER. Diploid with $2n = 10$ (Tzanoudakis, 1983) and tetraploid with $2n = 20$ (Tzanoudakis, 1983).

DISTRIBUTION. Confined to three Greek islands: Crete, Karpathos and Rhodes (Map 5.19).

NOTES. *Paeonia cretica* Sabine ex Lindl. (1824) was described on the basis of material from the Oxford Botanic Garden, but not from Crete, and is synonymous with *P. arietina* G. Anderson (1818). Tausch (1828) correctly described the plant collected by Sieber from the White Mountains, Crete, using the name *P. cretica*. Thus, *P. cretica* Tausch (1828)

is an illegitimate name, and was substituted by a new name, *Paeonia clusii* Stern (1940), named afterCLUSIUS, who is the first to mention the white peony in Crete in 1601.

Paeonia clusii is characterised by a high number of leaf segments, total glabrousness (except carpels and very occasionally the lower side of leaves), and white flowers. Stern (1946) stated that the species is similar to the *P. officinalis* group. Its leaf segments are mostly fine and it resembles the *P. officinalis* group in appearance but it differs from that group in having roots carrot-shaped, basipetally attenuate, not remarkably tuberous, leaves nearly always glabrous, and flowers white. Its closest relative seems to be *P. broteri* in the Iberian Peninsula. Both *P. clusii* and *P. broteri* have carrot-shaped roots and relatively high numbers of leaflets/leaf segments (11–32 in *P. broteri*), and they are both diploid and glabrous except for tomentose carpels. Molecular trees show that *P. clusii* is not closely related to the *P. officinalis* group, but instead is relatively closely related to the *P. broteri* and *P. coriacea* group (Sang, 1995).

This species comprises two allopatric subspecies.

- 1a. Leaf segments 23–95 in number, linear to lanceolate, up to 2.6 cm, very occasionally 3.2 cm wide 19a. subsp. *clusii*
1b. Leaf segments 23–48 in number, lanceolate to ovate, 2.5–4.5 cm wide 19b. subsp. *rhodia*

19a. *Paeonia clusii* subsp. *clusii*

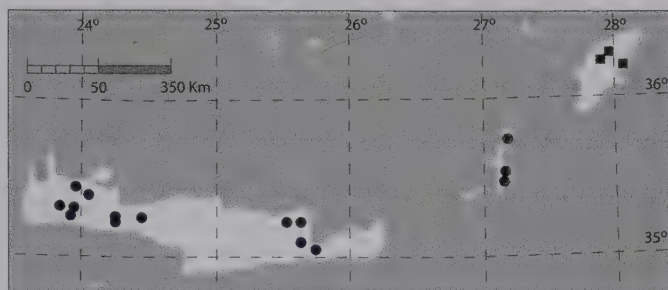
PHENOLOGY. Flowering from late March to May; fruiting in August.

CHROMOSOME NUMBER. Diploid with $2n = 10$ (Barber, 1941; Tzanoudakis, 1977, 1983), and tetraploid with $2n = 20$ (Tzanoudakis, 1977, 1983).

HABITAT AND DISTRIBUTION. Adapted to rather dry habitats, maquis in limestone areas, at altitudes from 200 to 1,900 m. Confined to two Mediterranean islands: Crete and Karpathos (Map 5.19).

DISTINGUISHING CHARACTERS. This subspecies has more and narrower leaf segments than subsp. *rhodia*.

ADDITIONAL SPECIMENS EXAMINED. GREECE, CRETE, HANIA PROV.: Askypchos, 20 July 1882, G. C. Spreitzenhofer s.n. (B, WU); Dikt, Gebirge, 3 July 1987, W. Burri & F. Krendl s.n. (W); Omalos, 24 May 1884, E. Reverchon s.n. (BM, G, K, P, WU); Omalos, Mt Volakias, Apr. 1970, O. Polunin 10032 (ATH); Lefka Ori, Omalos, 800–1,100 m, 25 Apr. 1942, K. H. Rechinger 12345 (BM, G, W); near Omalos, roadsides, in maquis, limestones, 1,040 m, 7 May 1966, S. C. Barelay 13 (K); Sfakia, 200 m, W of Asfendus, 35°14'283"N, 24°12'586"E, 870 m, limestone rocks, 23 Apr. 2003, N. Turland s.n. (MO); Mt Lefka Ori, summit Mavri, ENE of Kalergi, 1,600–1,900 m, 15 June 1977, E. Stamatiadou 19894 (ATH); Sfakia, Samaria Valley, 500–700 m, pine woods, 28 May 1972, J. Petamidis 1437 (ATH, BM); Sfakia, Talkessel V. Samaria, 630 m, 15 Apr. 1961, W. Greuter 3508 (W); Sfakia,



Map 5.19 Distribution of *Paeonia clusii* Stern: black circles = subsp. *clusii*; squares = subsp. *rhodia*.



Fig. 5.19A. *Paeonia clusii* Stern: **a**, carrot-shaped root (drawn by Miss LI Ai-Li); **b**, the lower part of the plant; **c**, a lower leaf; **d**, a flower; **e**, a flower with stamens and petals shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.

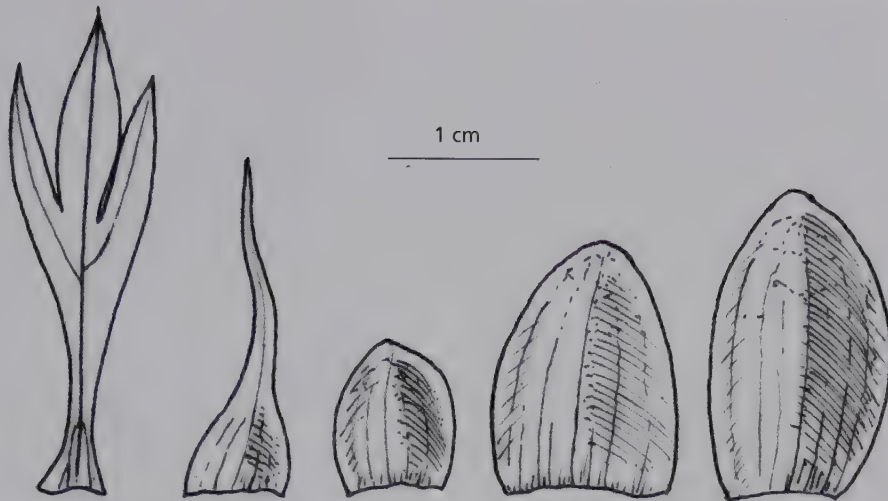


Fig. 5.19B. *Paeonia clusii* Stern: involucrate bracts and sepals, based on Crete, *P. H. Davis* 192 (K). Drawn by Mr SUN Yin-Bao.

1,250 m, 16 May 1998, *E. Hörandl* & *F. Hadaček* 8608 (W); Sfakia, Samaria Valley, above Samaria, 600–800 m, 28 June 1979, *Strid* & *Papanicolaou* 15143 (G); Sfakia, Lefka Ori, between Samaria and Hag. Nicolaos, c. 500 m, 14 June 1942, *K. H. Rechinger* 13726 (US, W); Lefka Ori, 1,600–1,700 m, 27 July 1987, *W. Burri* & *F. Krendl* s.n. (W); Lefka Ori, Samaria Valley, 7 June 1966, *C. Whitefoord* 111 (BM). **LASSITHION PROV.:** above Males, c. 700 m, 23 Apr. 1976, *D. Tzanoudakis* 6122 (GZU); Ajos Nikolaos, 630–650 m, 25 June 1969, *E. Stamatiadou* 6760 (ATH); *loc. eodem*, 15 Apr. 1971, *H. J. Leep* 71–11 (SA); Lassithion, Neapolis Exo Potamoi, c. 900 m, 11 Apr. 1971, *G. & W. Sauer* 12635 (SA). **LERAPETRA PROV.:** Crete Orient., Lerapetra Distr., near Males (Mallais), 14 Apr. 1900, *C. Leonis* 45 (G, K, WU); Melabes, 600 ped, May 1915, *M. Gandoger* s.n. (G); Kalamarka, 3000 ped, Apr. 1914, *P. Cousturier* s.n. (G); Pedhiadha Distr., between Iraklio and Lassithion, Krasion Village, 600 m, 4 Apr. 1974, *N. Goulondris*, 153 (ATH). **Rethimno:** Roumbado Village, 550 m, 28 Apr. 1973, *N. Goulondris* 110 (ATH, BM, E); Mt Agion Pneum, 1,200 m, *F. Guiol* 2139 (ATH); Potani, 900 m, 10 Apr. 1971, *M. Reisser* s.n. (W); Hoses, Mt White, 29 May 1938, *P. H. Davis* 192 (BM); Mt Lakous, 17 May 1883, *E. Reverchon* 3 (BM, E, G, P, WU); Mt Haghin, Preuma, 1,050 m, *S. C. Atchley* 1355 (K). **KARPATOS:** 610 m, 22 July 1950, *P. H. Davis* 18062 (K); c. 2–3 km E of Aperi, 200–300 m, 5 May 1990, *W. Burri* & *F. Krendl* s.n. (W); Mt Olymbos, “Profitis Ilias”, 450–600 m, 4 May 1969, *E. Stamatiadou* 6040 (ATH); Mt Olymbos, Larki, 550–600 m, limestones, 31 Mar. 1974, *E. Stamatiadou* 17762 (ATH, BM); Menetes, c. 400–500 m, 4 May 1990, *W. Burri* & *F. Krendl* s.n. (W); Menetes, Mt Hag. Elias, 400 m, 14 June 1935, *K. H. & F. Rechinger* 8144 (BM); *s. loc.*, 26 Apr. 1886, *F. Major* s.n. (G); *s. loc.*, 15 July 1886, *F. Major* s.n. (G).

19b. *Paeonia clusii* subsp. *rhodia* (Stearn) Tzanoud., *Cytotax. Study Gen. Paeonia in Greece*, 25 (1977); Phitos in *Strid & Kit Tan* (eds), *Fl. Hellenica*, 2: 78 (2002). *Paeonia rhodia* Stearn in *Gard. Chron.*, 150: 159, fig. 77 (1941); *Davis, Mill & Kit Tan, Fl. Turkey* 10: 22 (1988); *Halda, Gen. Paeonia*, 63 (2004). TYPE: Greece, Rhodes: Mt Profitze, c. 600 m, 19 Apr. 1938, *V. Engelhardt* s.n. (presented by Landby) (holotype K!).

PHENOLOGY. Flowering from late March to May; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (Stearn, 1941; Stern, 1944; Tzanoudakis, 1977, 1983).

HABITAT AND DISTRIBUTION. Growing in pine woods at an altitude of 350–850 m. Confined to Rhodes, an eastern Aegean island of Greece (Map 5.19).

DIAGNOSTIC CHARACTERS. The subspecies is different from the typical one in having fewer leaf segments (23–48), which are broader, lanceolate to broad-elliptic (2.5–4.5 cm wide).

ADDITIONAL SPECIMENS EXAMINED. GREECE, RHODES: Salakos, Mt San Elio, 11 June 1870, E. Bourgeau s.n. (BM, F, G, P, US); *loc. eodem*, May 1970, E. Bourgeau s.n. (G); *loc. eodem*, Apr. 1958, A. Seifert s.n. (M); Mt Profitis Elias, c. 850 m, *Pinus* forests, 24 Apr. 1978, O. Hedberg *et al.* 6622 (MO); *loc. eodem*, 550–700 m, pine woods, 27 Apr. 1969, E. Stamatiadou 5792 (ATH, BM); *loc. eodem*, c. 600 m, 21 Apr. 1968, I. C. Hedge s.n. (BM); *loc. eodem*, 15 Apr. 1959, W. Schacht s.n. (M); *loc. eodem*, Berwald, 5 Apr. 1985, Jurasky s.n. (WU); *loc. eodem*, 21 Apr. 1972, H. J. Leep s.n. (SA); above Arhangelos, rocky limestones, 350 m, 23 Mar. 1965, Davis 40312 (E).

20. *Paeonia daurica* Andrews, *Bot. Repos.* 7: tab. 486 (1807); Sims, *Bot. Mag.* 35: tab. 1441 (1812); de Candolle, *Syst. nat.* 1: 391 (1818); Anderson, *Trans. Linn. Soc. London* 12: 270 (1818); Stern, *J. Roy. Hort. Soc.* 68: 126 (1943); Stern, *Study Gen. Paeonia*, 70, cum tab. (1946); Grossheim, *Fl. Kavkaza* 4: 12 (1950) (*P. taurica* Andrews); Cullen & Heywood in Tutin *et al.* (eds), *Fl. Europ.* 1: 244 (1964); Davis & Cullen in Davis, *Fl. Turkey* 1: 205 (1965); Hong & Zhou, *J. Linn. Soc. Bot.* 143: 144 (2003); Hong, Wang, Zhang & Koruklu, *J. Linn. Soc. Bot.* 154: 8 (2007); *Paeonia corallina* Retz. var. *pallasii* Huth, *Bot. Jahrb. Syst.* 14(3): 267 (1891). TYPE: Andrews' tab. cited (holotype!).

Paeonia triternata Pall. ex DC., *Prodr.* 1: 65 (1824); Baker, *Gard. Chron.* n. ser. 22: 9 (1884); Pall., *Nov. Acta Petrop.* 10: 312 (1792) and *Tabl. Taur.* 52 (1795), nom. nud. *Paeonia corallina* Retz. var. *triternata* (Pall. ex DC.) Boiss., *Fl. orient.* 1: 97 (1867). *Paeonia mascula* (L.) Mill. var. *triternata* (Pall. ex DC.) Gürke in Richter, *Pl. eur.*, 2: 400 (1903). *Paeonia corallina* Retz. f. *triternata* (Pall. ex DC.) Rouy & Foucaud, *Fl. France* 1: 144 (1893). *Paeonia corallina* Retz. subsp. *triternata* (Pall. ex DC.) N. Busch in Kuznetsov, Busch & Fomin, *Fl. Caucas. Crit.* 3(3): 10 (1901) and 224 (1903). *Paeonia officinalis* L. subsp. *corallina* (Retz.) Fiori var. *triternata* (Pall. ex DC.) Fiori in Fiori & Paoletti (eds), *Fl. Italia* 1(2): 527 (1898), quoad nom. *Paeonia mascula* (L.) Mill. subsp. *triternata* (Pall. ex DC.) Stearn & P. H. Davis, *Peonies Greece*, 107, figs 33 and 34 (1984); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 294 (1993); Phitos in Strid & Kit Tan, *Fl. Hellenica* 2: 79 (2002). TYPE: Ukraine, Crimea, *P. S. Pallas* s.n. (lectotype here designated: BM!)

Perennials. Roots carrot-shaped, attenuate downwards, up to 4.6 cm in diameter. Lower leaves biternate with 9 leaflets, occasionally 1–2 leaflets segmented, and thus leaflets/leaf segments usually 9, rarely 10 or 11, in number, entire, broad-obovate, oblong, rarely wide-elliptic, sometimes undulate, truncate or rounded, rarely acute or even short-acuminate at the apex, 8–17 cm long, 4.8–11.5 cm wide, glabrous above, glabrous or sparsely to densely villose, or sparsely to rather densely puberulous beneath. Flowers solitary and terminal; involucre bracts 0–2 in number, leaf-like; sepals mostly 3, less frequently 2 in number, green but with purple periphery or entirely purple, orbicular or ovate-orbicular, up to 3.5 cm long, all rounded at the apex; petals 5–8 in number, usually red or rose, less frequently yellow, pale yellow, white, or yellow but with a red spot at the base or with red periphery; filaments purple; disk c. 1 mm high, waved, tomentose above; carpels 1–5 but mostly 2 or 3 in number, mostly tomentose, less frequently glabrous, hairs 2.5–3 mm long; stigmas nearly sessile, red, 1.5–2 mm wide. Figs 5.20A, 5.20B, 5.20C.

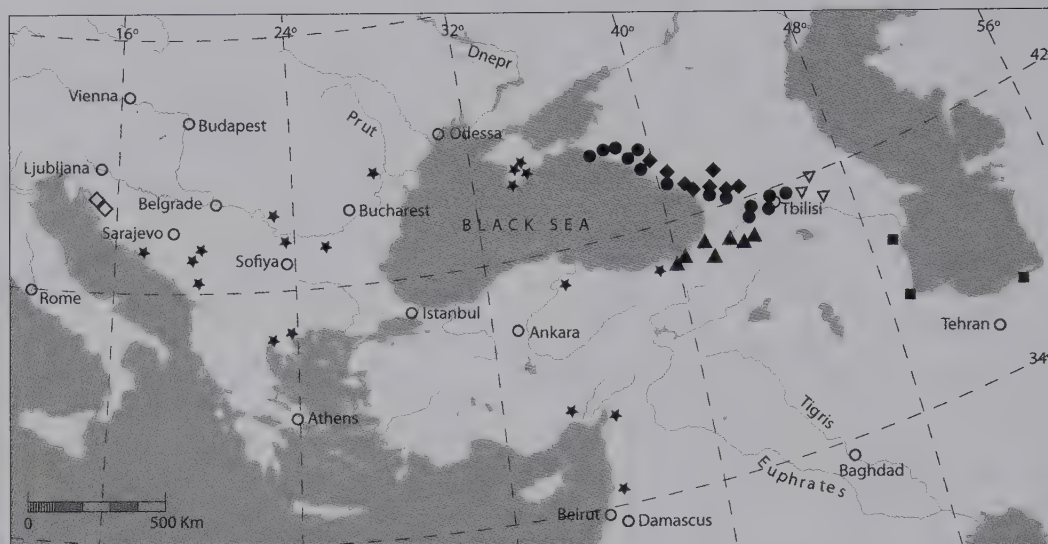
PHENOLOGY. Flowering from late April to early June; fruiting from August to September.

CHROMOSOME NUMBER. $2n = 10$ and 20 (see each subspecies for detail). Three lowland subspecies, subsp. *daurica*, subsp. *coriifolia* and subsp. *mlokosewitschii* are diploid, whereas three alpine or subalpine subspecies, subsp. *macrophylla*, subsp. *tomentosa* and subsp. *wittmanniana* are tetraploids. No chromosome information is yet available for subsp. *velebitensis*.

HABITAT AND DISTRIBUTION. Growing in deciduous broad-leaved or mixed forests, or at the edges of forests, on various media and at altitudes from 350 to 2,740 m. Widely distributed from Croatia in the west to N Iran in the east via Turkey and the Caucasus. Within the range of this



Fig. 5.20A. *Paeonia daurica* Andrews: **a**, a stem with a lower leaf and the terminal flower with petals and stamens shed, showing disk and carpels; **b**, carrot-shaped roots and caudex. Drawn by Miss LI Ai-Li.



Map 5.20. Distribution of *Paeonia daurica* Andrews: stars = subsp. *daurica*; black circles = subsp. *coriifolia*; open triangles = subsp. *mlokosewitschii*; triangles = subsp. *macrophylla*; black diamonds = subsp. *wittmanniana*; squares = subsp. *tomentosa*; open diamonds = subsp. *velebitensis*.

species, the populations in the Caucasus (including the Transcaucasus), the Talish Mountains and the Elburz Mountains are diverse and polytypical, both in morphology and chromosome number. They have been treated as five allopatric subspecies with subsp. *coriifolia* (diploid) in the lowlands of Georgia, subsp. *mlokosewitschii* (diploid) in E Georgia, NW Azerbaijan and Dagestan in Russia, subsp. *wittmanniana* (tetraploid) in the highlands of Abchasia (Georgia) and adjacent regions, subsp. *macrophylla* (tetraploid) in the western Transcaucasus (Armenia, Georgia and NE Turkey), and subsp. *tomentosa* (tetraploid) in the Talish Mountains (Azerbaijan and Iran) and the Elburz Mountains (Iran) (Hong & Zhou, 2003) (Map 5.20).

NOTES. In *Paeonia daurica*, the number of leaflets/leaf segments of lower leaves is mostly 9, rarely 10, very occasionally 11, whereas in *P. mascula* this ranges from 11 to 22, rarely 10, very occasionally 9. This character is rather stable within populations. In the population D. Y. Hong *et al.* H02215 (Mt Amanos, Hatay, Turkey), for example, we observed 37 individuals that all had 9 leaflets/leaf segments. On this mountain, there were hundreds of *P. daurica* individuals at altitudes from 1,300 to 1,550 m, but very few of them had more than 9 leaflets/leaf segments. The length of the terminal leaflets varied from 5.5 to 15.2 cm (9.2 ± 1.9 cm) in *P. daurica*, compared with 7.7–16.7 cm (11.8 ± 2.5 cm) in *P. mascula*. The ratio of the length to width ranged from 1.01 to 1.82 (1.45 ± 0.23) in *P. daurica*, and from 1.33 to 2.18 (1.79 ± 0.22) in *P. mascula*. The apex of terminal leaflets was mostly truncate, broad-rounded or rounded in *P. daurica*, but mostly acute, cuspidate or rounded-cuspidate in *P. mascula*. The widest point of the terminal leaflets also differed between the two species. Although the widest point was above the middle of the terminal leaflets in both entities, it was much above the middle, about halfway between the top and the middle in *P. daurica*, but not much above the middle in *P. mascula*. Thus, the terminal leaflets were broad-obovate or nearly orbicular in *P. daurica*, but obovate, oblong or ovate in *P. mascula*. As indicated by Hong *et al.* (2006), *P. daurica* was clearly, though not distantly, differentiated from *P. mascula* in morphology. They were not intermingled with each other, even in S Turkey where the two entities were sympatric. Morphologically, they differed in number of leaflets/leaf segments of lower leaves, and also in the shape of the terminal leaflets. The great majority of individuals of these two species could be distinguished.

Stearn and Davis (1984: p. 108) stated that *P. daurica* (= *P. mascula* subsp. *triternata*) and *P. mascula*

geographically overlapped in the eastern Aegean islands (Lesvos and Samos), and that they showed some morphological overlap in Anatolia. We critically examined all the specimens of this group from the regions mentioned above at the herbaria ATH, E, G, LD and UPA, but found that the specimens from Lesvos and Samos, including *E. Stamatiadou* 2666 (ATH) determined by P. H. Davis as *P. mascula* subsp. *triternata*, all belonged to *P. mascula* subsp. *mascula*. Thus, no subsp. *triternata* was present on these two islands. In Anatolia, subsp. *triternata* and subsp. *mascula* did coexist in some areas, e.g. in Hatay Province, Turkey, but they were not found to overlap morphologically. Instead, they were rather distinct. Their morphological differentiation can be easily understood when their difference in chromosome number is considered. No hybrids between them have been discovered.

Seven subspecies are recognised and keyed out below.

- 1a. Sepals often villose on the abaxial side; leaves rather densely villose on the lower side 20f. subsp. *velebitensis* D. Y. Hong
- 1b. Sepals glabrous; leaves sparsely villose or puberulous, less frequently densely villose on the lower side or glabrous.
 - 2a. Carpels glabrous or nearly glabrous; petals yellow.
 - 3a. Leaflets/leaf segments densely villose and thus greyish beneath 20c. subsp. *macrophylla* (Albov) D. Y. Hong
 - 3b. Leaflets/leaf segments usually sparsely villose beneath 20g. subsp. *wittmanniana* (Hartwiss ex Lindl.) D. Y. Hong
 - 2b. Carpels tomentose; petals red, rose, white or yellow.
 - 4a. Leaflets/leaf segments puberulous or glabrous beneath, obovate, apex rounded or obtuse, often with a short mucro . . 20d. subsp. *mlokosewitschii* (Lomakin) D. Y. Hong
 - 4b. Leaflets/leaf segments villose or glabrous beneath, obovate, oblong or wide-elliptic, apex rounded to short-acuminate.
 - 5a. Petals red or rose; leaflets/leaf segments glabrous or sparsely villose beneath.
 - 6a. Leaflets/leaf segments broad-obovate, truncate to rounded at apex 20a. subsp. *aurica*
 - 6b. Leaflets/leaf segments obovate to oblong, rounded to acute at apex 20b. subsp. *coriifolia* (Rupr.) D. Y. Hong
 - 5b. Petals yellow or yellowish white, but sometimes red at periphery or with a red spot at base; leaflets or segments villose beneath.
 - 7a. Leaflets/leaf segments mostly densely villose and thus greyish beneath 20e. subsp. *tomentosa* (Lomakin) D. Y. Hong
 - 7b. Leaflets/leaf segments usually sparsely villose beneath 20g. subsp. *wittmanniana* (Hartwiss ex Lindl.) D. Y. Hong

20a. *Paeonia daurica* subsp. *aurica*

Paeonia corallina Retz. var. *triternatiformis* A. Nyár. in Săvulescu (ed.), *Fl. Reip. Pop. Român.* 2: 403, 675, pl. 65, fig. 2 (1953). TYPE: Nyárády's figure cited (holotype!).

PHENOLOGY. Flowering from middle April to early June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (Barber, 1941; Stern, 1944; Tzanoudakis & Arampatzis, 1998; the present work with the voucher: Turkey, Hatay, D. Y. Hong *et al.* H02213 (MO, PE)).

HABITAT AND DISTRIBUTION. Growing in woods at altitudes from 350 to 1,550 m. Distributed in Bosnia-Herzégovina, Croatia, Serbia, Macedonia, Romania, Bulgaria, Ukraine (Crimea), Greece (Drama), Turkey, Syria and Lebanon (Map 5.20).

ADDITIONAL SPECIMENS EXAMINED. BOSNIA-HERZÉGOVINA, Mt Jamnica, near Vardiste, 860–1,000 m, 30 May 1911, K. Maly s.n. (K). BULGARIA: Turnovo Town, 1904, I. K. Urumov

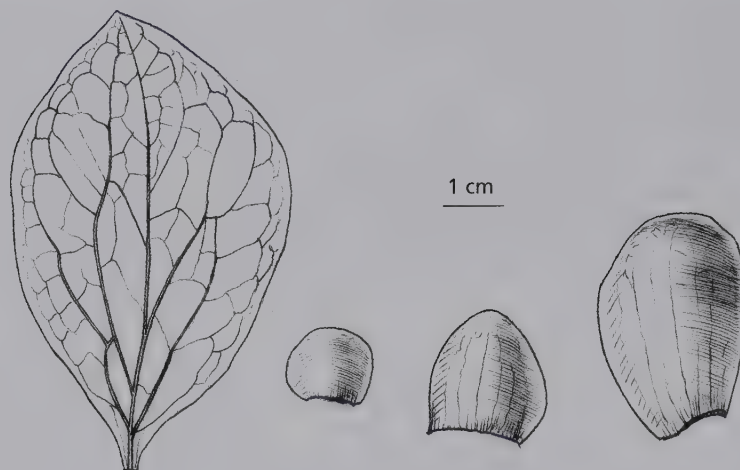


Fig. 5.20B. *Paeonia daurica* Andrews subsp. *daurica*: involucrate bracts and sepals, based on D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02221 (A, CAS, K, MO, PE, UPA). Drawn by Mr SUN Yin-Bao.

s.n. (SOM); Vratsa Town, June 1898, s. coll. s.n. (SOM). **CROATIA, Dubrovnik (Ragusa):** Mt Dalmatia, Adamovic s.n. (WU). **GREECE, DRAMA PROV. (MACEDONIA):** Mt Menikio, c. 10 km from Panorama, 41°15'N, 23°44'E, 1,050 m, 27 May 1996, T. Arampatzis & K. Vidakis s.n. (UPA). **LEBANON, s. loc.,** 31 May 1879, E. Peyron 544 (G). **MACEDONIA, Demir Kapija,** 9 June 1925, P. âernjanski s.n. (BEO). **ROMANIA, BUZAU:** Gura, Savatii, 350 m, 17 Aug. 1948, C. Dobrescu s.n. (BUCA); Savateanca, N of Ciuhoiu Village, in forests, 400 m, 5 May 1948, C. Dobrescu s.n. (BUCA); Niscov Valley, Cheia, Tisau County, in *Fagus*–*Carpinus* forests, 14 Apr. 1959, G. Dihoru s.n. (BUCA); Mt Ciolanu, 2 May 1966, R. Wallfisch s.n. (BUCA). **MEHEDINTI:** Virciorova, in forests, 18 May 1966, N. Roma s.n. (BUCA); loc. eodem, Goinovat, 350 m, 9 Aug. 1948, E. Topa s.n. (BUCA). **SERBIA, KOSOVO:** Kosovska, Mitrovica, 28 May 1949, S. Matvejev s.n. (BEO); between Kosovo and Albania, Mt Koritnik, May 1937, H. Oehm s.n. (BEO); between Kosovo and Albania, Pastrok, 500–1,500 m, 26 July 1979, N. Diklić & V. Nikolić s.n. (BEO); Srbija, Belevik, Istok, 950–970 m, 14 June 1997, B. Panjković s.n. (NSAD). **TURKEY, ANTALYA,** 1,000 m, 25 Aug. 1941, P. H. Davis 14287 (K). **GÜMÜSHANE:** Kalkanli, Zigana, 19 May 1972, H. J. Leep s.n. (SA). **HATAY:** Mt Amanos, above Topaktas, 1,290 m, 18 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02213 (MO, PE); loc. eodem, 1,380–1,540 m, 18 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02215 (A, CAS, K, MO, PE, UPA); Belen, Suguk Oluk, 1,200 m, 24 Apr. 1957, Davis & Hedge D27104 (ANK); Dörtöyl, Kuzuculu to Bülke, 1,000 m, in forests, 4 May 1965, M. J. E. Coode & B. M. G. Jones 443 (E). **ISPARTA,** Egirdir Lake, Yaka Village, 1300–2,100 m, *Pinus nigra*–*Juniperus excelsa* forests, 19 May 1973, H. Pesman & A. Güner 3467 (ANK). **SAMSUN:** Havza, Taskaraca–Oren Village, 880–920 m, 21 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02221 (A, CAS, K, MO, PE, UPA); Burial Mound, 800 m, 10 May 1963, C. Tobey 101 (E); Ladik, Kara Dağ, 1,150–1,200 m, oak scrubs, 8 May 1965, C. Tobey 944 (E). **ASIA MINOR, s. loc., Aucher-Eloy** 4019 (BM, G). **UKRAINE, CRIMEA:** Simferopol, near Neusatz, in woods, 7 May 1900, A. Gallier 526 (BM, E, G, K, P, WU); Baidar, in woods, 1899, M. Wetzchky s.n. (G); near Stavri-Kaja, Neon Village, 26 Apr. 1913, J. Wankow s.n. (K); Jalta (Yalta), in woods, 18 May 1910, J. Wankow (B); Jalta, Nikitsky Yaila, Karst gully, 1,350 m, 3 June 1959, Davis 33373 (E, G, K, LE); loc. eodem, pine woods, 4 July 1946, Kutova s.n. (LE); Jalta, Mt Laila, 700–800 m, 27 Apr. 1979, S. Husak s.n. (GZU); loc. eodem, 1 May 1905, N. A. Busch s.n. (LE); Jalta Region, near Baidarskie Verota, in *Fagus* forests, 22 May 1922, S. Ganeshin s.n. (LE);

Aluschda, Welder des Tschatyr-Dagh, 18 June 1895, *A. Gallier* s.n. (WU); *s. loc.*, *W. Besser* s.n. (E, K); *s. loc.*, *H. A. Bunge* s.n. (P); *s. loc.*, July 1885, *Jelenetzky* s.n. (G); *s. loc.*, 11 June 1893, *O. & B. Fedtschenko* s.n. (G); *s. loc.*, May 1828, *Govet* s.n. (G); Bakhchisarai, 500–700 m, 30 July 1977, *V. Vašák* s.n. (W); Sevastopol, 500 m, 12 May 1991, *V. Vašák* s.n. (W); Mt Bedenekir, forest glades, 16 May 1898, *K. Golde* s.n. (LE); Pendike, 28 May 1898, *K. Golde* s.n. (LE); above Uchan-Su, 15 May 1896, *K. Golde* s.n. (LE); Last Valley, 4 May 1905, *N. A. Busch* s.n. (LE); between Otus and Koktebek, 10 May 1905, *N. A. Busch* s.n. (LE); Karadag, *Quercus* forests, 2–7 Aug. 1968, *T. Hort*, *A. Bobrov* & *V. Siplivinsky* s.n. (LE); Grushevaja Poljana Nature Reserve, in forest, 25 July 1955, *M. Kitov* s.n. (LE); near Kokkoz, in forest, 23 May 1929, *S. Stankov* & *A. Pegova* s.n. (LE).

20b. *Paeonia daurica* subsp. *coriifolia* (Rupr.) D. Y. Hong, *J. Linn. Soc. Bot.* 143: 145 (2003). *Paeonia triternata* Pall. ex DC. f. *coriifolia* Rupr., *Mem. Acad. Imp. Sci. St.-Petersburg.* ser. 7, 15(2): 46 (1869). *Paeonia corallina* Retz. var. *coriifolia* (Rupr.) Grossh., *Fl. Kavkaza* 2: 91 (1930). *Paeonia corallina* Retz. subsp. *triternata* (Pall. ex DC.) N. Busch var. *coriifolia* (Rupr.) N. Busch in Kuznetsov, Busch & Fomin, *Fl. Caucas. Crit.* 3(3): 12 (1901). *Paeonia caucasica* (Schipcz.) Schipcz. var. *coriifolia* (Rupr.) Schipcz. in Komarov, *Fl. USSR* 7: 29 (1937). *Paeonia kavachensis* Azn. var. *coriifolia* (Rupr.) Grossh., *Fl. Kavkaza* 4: 12 (1950). TYPE: Georgia: Igoeti, 630 m, 2 May 1999, *D. Y. Hong* & *S. L. Zhou* H99029 (neotype here designated, K!; isoneotypes A!, CAS!, MO!, PE!, US!).

Paeonia caucasica (Schipcz.) Schipcz. in Komarov, *Fl. USSR* 7: 28, pl. 3-1 (1937); Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 23 (1961). *Paeonia corallina* Retz. var. *caucasica* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 45 (1921); Grossheim, *Fl. Kavkaza* 2: 91 (1930). TYPE: Schipczinsky's plate cited (neotype designated by Hong & Zhou, 2003: 145!).

Paeonia ruprechtiana Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 22 (1961). TYPE: Georgia, Imeretia, Schorapan, near village Parckhali, 18 Apr. 1916, *I. Buachidze* s.n. (holotype TBI!).

Paeonia kavachensis auct. non Azn. (in *Magyar Bot. Lapok* 16: 7 (1917)), Grossheim, *Fl. Kavkaza*, 4: 12 (1950).

Paeonia triternata auct. non Pall. ex DC.: Ruprecht, *Mem. Acad. Imp. Sci. St.-Petersburg.* ser. 7, 15(2) (*Fl. caucasi*), 44 (1869); Lipsky, *Trudy Tiflissk Bot. Sada*, 4 (*Fl. Caucasi*), 213 (1899); Schipczinsky in Komarov, *Fl. USSR* 7: 28 (1937), pro parte, excl. pl. *Crim.*; Kemularia-Nathadze *Trudy Tbilissk Bot. Inst.* 21: 26 (1961).

PHENOLOGY. Flowering from late April to May; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (Punina, 1987, 1989).

HABITAT AND DISTRIBUTION. Found at altitudes below 1,100 m in deciduous forests, dominated by *Quercus*, *Fagus*, *Ulmus*, *Acer* and *Fraxinus*, or in mixed deciduous broad-leaved and coniferous forests, dominated by *Picea*, *Fagus* and *Quercus*. On a wide range of media: sandstones, limestones and volcanic rocks. Confined to W and NW Caucasus (Map 5.20).

DIAGNOSTIC CHARACTERS. *Paeonia daurica* subsp. *coriifolia* differs from the other subspecies in having red petals and leaflets that are glabrous or sparsely villose beneath.

ADDITIONAL SPECIMENS EXAMINED. **ARMENIA**, *s. loc.*, *Szovits* s.n. (US). **GEORGIA: Abchasia:** Sukhumi, near Jurjevskoje, 31 Mar. 1912, *Woronow* s.n. (LE); Sukhumi, near Yurievka, Apr. 1900, *Woronow* s.n. (LE); Ritza region, near Avadhary, 8 May 1973, *Maximova* 133 (LE). **Imereti:** Kharagouli, Partskhnali, 27 Mar. 1966, *A. Kharadze* s.n. (TBI); *loc. eodem*, 23 Mar. 1966, *A. Kharadze* s.n. (TBI); Marilisi-Didvake, edges of forests, 25 Mar. 1965, *Tshikvaidze* s.n. (TBI); Ladogani, in forest, 30 May 1928, *Kemularia-Nathadze* s.n. (TBI); Tkibuli, near Akhal-Sopeli Village, Mt Tsintskala, 4 May 1948, *Kuzhazheladze* s.n. (TBI). **Kachetia**, Chalaubani, May 1984, *Mikheev* s.n. (LE). **Kartli:** Borjomi, National Park, 41°50'N, 43°22'E, N slopes, 870 m, 4 May 1999, *D. Y. Hong* & *S. L. Zhou* H99039 (MO, PE); Bamiskhevi, 11 May 1918, *W. Kozlowsky* s.n.

(TBI); Gombori, Ujarma Village, 12 May 1964, *Ketskovieli et al.* s.n. (TBI); Igoeti, 630 m, Apr. 1959, *Ketskovieli* s.n. (TBI) and 6 May 1959, *Ketskovieli* s.n. (TBI); *loc. eodem*, *Quercus–Cornus–Acer* forests, 2 May 1999, D. Y. Hong & S. L. Zhou H99029 (A, CAS, K, MO, PE, US). **Ratscha-Letskhum:** Alpana, Mt Koitschu, 12 Apr. 1932, *Kemularia-Nathadze* s.n. (TBI); between Mekvena and Alpana, in forests, 23 Mar. 1966, *Kemularia-Nathadze* s.n. (TBI); Oni, Oni Valley, 5 Apr. 1937, A. Schkhian s.n. (TBI); Tsagerski, Rioni Valley, 19 Apr. 1987, *Nikitia et al.* s.n. (LE); Sairme, 30 Mar. 1966, R. Gagnidze & I. Mikeladze s.n. (TBI); near Orbeli, 29 Mar. 1966, R. Gagnidze & I. Mikeladze s.n. (TBI). **Tbilisi:** near ruins of Gudareha, near Bely Klush, 17 May 1908, *Florensky* s.n. (LE); Saguramo, 24 May 1960, *Mordak* 486 (LE). **Trialeti,** near Manglisi, 1,100 m, 23 May 1965, *Abaschidze* s.n. (LE, TBI). **RUSSIA: Krasnodar:** path to Belorechensky Pass, 10 June 1973, *Sergienko* s.n. (LE); the upper reaches of Shahe River, Belorechensky Mountain Pass, 23 May 1923, *Malysheva & Solodko* s.n. (LE); *loc. eodem*, limestones, 20 June 1983, *Sergienko* s.n. (LE); Guzerkilo, 19 July 1928, *Leskov* 203 (LE); Kluych, E of Klyuch, 44°35'N, 39°06'E, 400 m, virgin deciduous broad-leaved forests, sandstones, 16 May 1999, D. Y. Hong & S. L. Zhou H99059 (A, CAS, K, MO, PE, US); Abtal, 5 Apr. 1987, *Mordak & Dorofeev* 2273/191 (LE); Dante's Gorge, Goriachy Kluych, 6 May 1969, *Maximova* s.n. (LE); Holodny, Erin, near Goriachy Kluych, 11 May 1907, *Busch & Klopoto* s.n. (E, LE); Kuban, between Ahota and Veliaminovskiy Mountain Pass, 25 Apr. 1907, *Busch & Klopoto* s.n. (LE); Kuban River, upper reaches, June 1912, Z. *Atmanskih* s.n. (LE). **Maykop:** road to Tuapse, Apr. 1911, N. *Shestunov* 1275 (LE); Mostovskiy, near Psebai, 28 July 1990, *Menitskiy et al.* 15 (LE); near Neberdzhavskaya, 16 Apr. 1907, *Busch & Klopoto* s.n. (LE); near Erivanskaya, Mt Shize, 21 Apr. 1907, *Busch & Klopoto* s.n. (LE); N Caucasus: upper reaches of Psecha River, near Goishkh, 12 Aug. 1946, *Gavrilevich* s.n. (LE); upper reaches of Psecha River, Mt Tuby, 700 m, 1 Aug. 1946, *Chernovol* s.n. (LE); upper reaches of Psecha River, near Tuby, 500 m, 1 Aug. 1946, *Sochava* s.n. (LE). **Novorossisk:** s. *loc.*, 22 May 1889, *Lypskiy* s.n. (LE); Anapa, 25 May 1958, *Kotov & Omelchuk* s.n. (LE); Gelendzhik, Mikhailowsky Mountain Pass, 3 Aug. 1990, *Menitskiy et al.* 22 (LE); Novorossisk, Apr. 1897, *Akinfiyev* s.n. (LE). **Sochi:** near Agur, 100–450 m, 8 June 1976, V. *Vašák* s.n. (W); Akhum, above Oppidum, 600–650 m, 8 June 1978, V. *Vašák & A. Vézda* s.n. (W); Dagomys, 21 July 1937, *Vekilunov* 32 (LE); near Krasnaya Poliana, 20 May 1981, *Lebedeva* s.n. (LE); Krasnaya Poliana, 30 Mar. 1987, *Mordak & Dorofeev*, 2183/102 (LE); Krasnaya Poliana, Mt Aibga, 900–1,000 m, 11 May 1930, *Muhin* 10 (LE); Sochi, 19 Apr. 1930, *Uhanov* s.n. (LE); Hosta, 15 Apr. 1930, *Uhanov* s.n. (LE); Agur Valley, 9 Apr. 1924, *Shteip* s.n. (LE). **Tuapse:** Kuibyshevka, 15 June 1986, *Chernovol* s.n. (LE); *loc. eodem*, 25 June 1986, *Chernovol* s.n. (LE). **Stavropol,** Korachaevo-Cherkesskaya Autonomous Land, W end of Mt Pastbishny, 17 June 1988, *Geltman et al.* 1211 (LE).

20c. *Paeonia daurica* subsp. *macrophylla* (Albov) D. Y. Hong in Hong & Zhou, *J. Linn. Soc. Bot.* 143: 147 (2003). *Paeonia corallina* Retz. var. *wittmanniana* (Steven) Albov f. *macrophylla* Albov, *Prodr. Fl. Colchic.*, 15 (1895). *Paeonia macrophylla* (Albov) Lomakin, *Trudy Tiflissk Bot. Sada* 2: 282 (1897); Lipskiy in *Trudy Tiflissk Bot. Sada (Fl. caucasi.)* 4: 213 (1899); Schipczinsky in Komarov, *Fl. USSR* 7: 32 (1937); *Kemularia-Nathadze*, *Trudy Tbilissk Bot. Inst.* 21: 14 (1961). *Paeonia wittmanniana* Steven f. *macrophylla* (Albov) N. Busch in Kuznetsov, Busch & Fomin, *Fl. Caucas. Crit.* 3(3): 13 (1901) and 224 (1903). *Paeonia wittmanniana* Steven var. *macrophylla* (Albov) N. Busch ex Grossh., *Fl. kavkaza* 2: 91 (1930); Stern, *Study Gen. Paeonia*, 61 (1946). TYPE: Georgia, Adjara, Mt Chakvis-Mta, above Agara Village, 800–1,000 m, 14 July 1893, N. Albov 157 (lectotype designated by Hong & Zhou 2003: 147, G!); *loc. eodem*, 14 July 1893, N. Albov 156 (syntype G!); *loc. eodem*, 14 July 1893, N. Albov 160 (syntype G!); *loc. eodem*, 14 July 1893, N. Albov 161 (syntype K!). *Paeonia wittmanniana* Steven, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 21(3): 275 (1848); Boissier, *Fl. orient.* 1: 97 (1867); Lipskiy, *Trudy Tiflissk Bot. Sada (Fl. caucasi.)* 4: 213 (1899), pro parte, excl. var. *Paeonia corallina* Retz. var. *wittmanniana* (Steven) Albov, *Prodr. Fl. Colchic.* 14 (1895), pro

parte, quoad pl. Guria; *Paeonia steveniana* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 15 (1961).
TYPE: Georgia, Meskheta, between Akhaltsikhe and Kartalinia, near Atskhur, May 1840.
Wittmann s.n. (holotype LE!).

Paeonia wittmanniana Hartwiss ex Lindl. var. *nudicarpa* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR*, 2: 44, 1921; Stern, *Study Gen. Paeonia*, 59, cum tab (1946); Grossheim, *Fl. Kavkaza* 4: 12 (1950); Güner, *Notes Roy. Bot. Gard. Edinburgh* 41(2): 283 (1983). TYPE: Georgia: Borjomi, Bakuriani, 12 June 1934, *P. S. Massagetov* s.n. (neotype here designated, LE!).

Paeonia wittmanniana auct. non Hartwiss ex Lindl.: Davis, Mill & Kit Tan, *Fl. Turkey* 10: 22 (1988).

Paeonia hartwissiana Hort ex Trautv., *Trudy Imp. S.-Petersburgsk. Bot. Sada* 8: 61 (1883), nom. nud.

PHENOLOGY. Flowering from late May to June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 20$ (Punina, 1987, 1989).

HABITAT AND DISTRIBUTION. Growing at altitudes from (800)–1,160–2,400 m, in deciduous forests or mixed coniferous and deciduous broad-leaved forests, and also in glades, with no specific soil preference. Confined to high mountainous areas in Armenia, SW Georgia (Adjara, Guria, S Imereti, SW Kartli and Meskheta) and NE Turkey (Map 5.20).

NOTES. This subspecies was established as a new taxon by Albov (1895) and raised to specific rank by Lomakin (1897) on the basis of its large leaflets. The entity is characterised by larger leaflets and glabrous carpels. Glabrous carpels also occur, however, in subsp. *wittmanniana* and occasionally in subsp. *tomentosa*, and we have shown that the larger leaflets are within the continuous variation of leaflet size in *Paeonia daurica*. We have not found any other character that distinguishes subsp. *macrophylla* clearly from the other subspecies of *P. daurica* (Hong & Zhou, 2003).

ADDITIONAL SPECIMENS EXAMINED. **ARMENIA**, *s. loc.*, Szovits s.n. (WU). **GEORGIA: Adjara:** Machuntseti, 1,160 m, *Fagus* forests, 21 May 1999, D. Y. Hong & S. L. Zhou H99065 (A, CAS, K, MO, PE, US); between Batumi and Akhaltsikhe, above Danais Pasaul, in forests, 23 June 1890, S. Sommier & E. Levier 47 (G); Machuntseti Village, 1,200 m, *Davidadze* s.n. (BATU); Loididziri, 6 Aug. 1910, Y. Woronow & Popov 1205 (LE); Kobuleti, Dibvoke, 1,200 m, 21 May 1962, *Dmitrieva* s.n. (LE); Beschumi, 2,025 m, *Davidadze* s.n. (BATU); Adjara–Guria Gorge, Nagvarevis–Khevi to Gomis–Mta Pass, 2,100 m, A. Dolukhanov & A. Kazarova s.n. (TBI); Akho–Iaila, near Xalebashvili, subalpine zone, 8 Aug. 1939, G. Kvaratskhelia s.n. (TBI). **Guria:** Mt Somlia, 8–10 km from Bahmaro, c. 2,200 m, 2 Sep. 1980, *Zaikonnikova* s.n. (LE); Adjara–Imeretinsky Mountain Range, Mt Gurusky, alpine pastures, Zortis–Keli, 3 July 1914, *Kikodze* s.n. (LE); *loc. eodem*, near Bahmaro, 6 July 1914, *Kikodze* s.n. (LE); the same range, the gorge of Gedis–Dere River, 22 Dec. 1921, *Meffert* 957 (LE); Mt Bahmaro–Zotiskheli, 1,800–2,000 m, 15 June 1893, N. Albov 252 (G) and 255 (G); *loc. eodem*, 1,900–2,000 m, 15 June 1893, N. Albov 318 (G); Guria, Somlia, 1,850 m, 19 June 1893, N. Albov 229 (G). **Imereti,** Lukhunis–Tskali, c. 1,250 m, 3 Aug. 1958, *Dolukhanov* s.n. (TBI). Ermani: Delavars, 5 July 1937, *Busch* s.n. (LE); Delavars, between Nizhny Ermani and Shavlokhovo, 1,850–2,200 m, 24 Aug. 1929, *Busch* s.n. (LE); Ahubat: 24 June 1940, *Sharova* s.n. (LE); Ahubat, between Ermani and Edis, 2,000 m, 24 June 1936, *Busch* s.n. (LE); Edis, 29 June 1938, *Abramov* s.n. (LE); Hodzhehor, 19 Aug. 1930, *Busch* s.n. (LE). **Kartli:** Borjomi, Bakuriani 1,700–1,800 m, 25 July 1984, *Punina* s.n. (LE); *loc. eodem*, 29 May 1957, *Harkevich* s.n. (LE); Bakuriani, between Andeziti and Sakotschavi, 9 July 1957, I. Tschaidze s.n. (LE, TBI); Bakuriani, near the botanical garden, 25 July 1960, *Kemularia–Nathadze* s.n. (TBI); Borjomi, in forests, 15 May 1917, D. Sosnowsky s.n. (TBI); Baniskhevi, 24 May 1920, W. Kozlowsky s.n. (TBI); Sakotschavi, near Bakuriani, Aug. 1935, *Barnabishvili* s.n. (TBI); near the Kvabiskhevi River, 10 km from Kvabiskhevi, 3 June 1964, *s. coll.* s.n. (TBI); Bakuriani, 1,700 m, N slopes, volcanic rocks, 19 May 1999, D. Y. Hong & S. L. Zhou H99060 (A, CAS, K, MO, PE, US) and S slopes, 1,850 m, 19 May 1999, D. Y. Hong & S. L. Zhou H99062 (MO, PE). **Meskheta,** Adjara–Imeretinsky Mountain Range, Oshora, 15 Aug. 1926, *Meffert* 956 (LE). **TURKEY, Artvin,** Yalniczam Silsilesi, 10 km ESE of Savsat, 2,000–2,400 m, 10 July 1967, *Albury, Cheese & Watson* 3160

(K). **Rize:** İkizdere, above Mesekey Village, 1,850 m, 15 Nov. 1993, *M. Pitman & A. Wickham Turx* 253 (K); Çamlıhemflin, Yukari Amlakit Yaylasi, alpine meadows, granites, 2,300 m, 25 June 1981, *A. Güner* 3842 (E); S Ardesen, Çamlıhemflin, Elenit-Alm, 2,200 m, 28 June 1971, *E. & H. M. Steiner* 98 (W). **Trabzon,** Sürmene, Köprübaşı, 3 km to Arpali Village, Vizara River, 1,550 m, open woods, 25 May 1983, *A. Güner & M. Vural* AG4922 (ANK).

20d. *Paeonia daurica* subsp. *mlokosewitschii* (Lomakin) D. Y. Hong in Hong & Zhou, *J. Linn. Soc. Bot.* 143: 146 (2003). *Paeonia mlokosewitschii* Lomakin, *Trudy Tiflissk Bot. Sada* 2: 282 (1897); Lipsky, *Trudy Tiflissk Bot. Sada (Fl. caucasi)* 4: 213 (1899); Busch in Kuznetsov, Busch & Fomin (eds), *Fl. Caucas. Crit.* 3(3): 14 (1901); Grossheim, *Fl. Kavkaza* 2: 91 (1930) and *Fl. Kavkaza* 4: 13 (1950); Schipczinsky in Komarov, *Fl. USSR* 7: 26 (1937); Stern, *Study Gen. Paeonia*, 54 (1946); Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 20 (1961); *Paeonia triternata* Pall. ex DC. var. *mlokosewitschii* (Lomakin) Stebbins, *Genetics* 23: 86 (1938). TYPE: Georgia, Kachetia, near Lagodekhi, 9 Apr. 1901, *Mlokosewitsch* 57 (neotype designated by Hong & Zhou 2003: 146, TBI!; isoneotypes E!, LE!) *Paeonia lagodechiana* Kem.-Nath., *Trudy Tbilissk Bot. Inst.* 21: 25 (1961). TYPE: Georgia: Kachetia, Lagodekhi, Ninigora, 10 Apr. 1953, *Kazarova & Dolukhanov* s.n. (holotype TBI!)

PHENOLOGY. Flowering from April to May; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (Barber, 1941; Leeper; 1968; Punina, 1987, 1989; Stebbins, 1938a; Stern, 1944).

HABITAT AND DISTRIBUTION. Growing in deciduous forests dominated by *Fagus*, *Quercus*, *Ulmus*, *Castanea* and *Acer*, at an altitude of 960–1,060 m. To date, found only in E Georgia, NW Azerbaijan and Dagestan in Russia (Map 5.20).

NOTES. The type specimens of *Paeonia mlokosewitschii* and *P. lagodechiana* both came from the same population, which we visited and observed during our expedition in 1999. This population (*D. Y. Hong & S. L. Zhou* H99035) was extremely polymorphic in petal colour (Fig. 3.13B) and leaflet indumentum.

Among the seven subspecies of *Paeonia daurica*, subsp. *mlokosewitschii* is relatively distinct; its leaflets are usually obovate, rounded and mucronate at the apex, and mostly sparsely or rather densely puberulous but sometimes glabrous beneath.

Saunders and Stebbins (1938) made a cross between *Paeonia triternata* from SE Europe (= *P. daurica* subsp. *daurica*) and this entity, which showed that they were interfertile. This suggests that *P. mlokosewitschii* might be better treated as a subspecies within *P. daurica*.

ADDITIONAL SPECIMENS EXAMINED. AZERBAIJAN, Zakataly, forests, 9 May 1963, *Zansheb* s.n. (BAK). **GEORGIA, Kachetia:** Lagodekhi, Mt Kudigora, 960 m, 29 May 1954, *A. Dolukhanov* s.n. (TBI); *loc. eodem*, 1,060 m, 13 May 1954, *A. Dolukhanov* s.n. (TBI); Lagodekhi, 5 May 1939, *Kemularia-Nathadze* s.n. (TBI); *loc. eodem*, 12 May 1939, *Kemularia-Nathadze* s.n. (TBI); *loc. eodem*, 6 May 1958, *Kemularia-Nathadze* s.n. (TBI); *loc. eodem*, in forests, 13 May 1939, *O. Kapeller* s.n. (TBI); *loc. eodem*, 41°51'N, 46°15'E, 1,040 m, 3 May 1999, *D. Y. Hong & S. L. Zhou* H99035 (A, CAS, K, MO, PE, US). **Kiziki:** Shiraki, Kvemo Kedi, along Alazan River, 25 Apr. 1985, *Punina* s.n. (LE); Shiraki, introduced to Tbilisi Botanic Garden, 11 May 1976, *Kemularia-Nathadze* s.n. (TBI). **RUSSIA, Dagestan:** upper part of Stvarskoe-koisu River, near Takhoti Village, 28 June 1948, *A. Dolukhanov* s.n. (TBI).

20e. *Paeonia daurica* subsp. *tomentosa* (Lomakin) D. Y. Hong in Hong & Zhou, *J. Linn. Soc. Bot.* 143: 148 (2003). *Paeonia wittmanniana* Steven var. *tomentosa* Lomakin, *Trudy Tiflissk Bot. Sada* 2: 283 (1897); Lipsky, *Trudy Tiflissk Bot. Sada*, 4 (*Fl. caucasi*), 213 (1899). *Paeonia wittmanniana* Steven subsp. *tomentosa* (Lomakin) N. Busch in Kuznetsov, Busch & Fomin, *Fl.*

Caucas. Crit. 3(3): 14 (1901). *Paenonia tomentosa* (Lomakin) N. Busch in Fomin & Woronichin, *Opred. Rast. Kavkaza, Kryma*, 7 (1919); Grossheim, *Fl. Kavkaza* 2: 91 (1930); Stapf, *Bot. Mag.* 155: tab. 9249 (1931); Schipczinsky in Komarov, *Fl. USSR* 7: 32 (1937); Stern, *Study Gen. Paenonia*, 56 (1946), pro syn; Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 19 (1961). TYPE: Azerbaijan, the Talish Mountains, Mt Nudus-Galasi, c. 1,800 m, 17 June 1894, Lomakin s.n. (lectotype designated by Kemularia-Nathadze 1961, TBI!)

Paenonia mlokozewitschii auct. non Lomakin: Grossheim, *Fl. Kavkaza*, 4: 13 (1950), pro parte, excl. specim. Lagodech.

Paenonia corallina Retz. var. *triterinata* (Pall. ex DC.) Boiss., *Fl. orient.* 1: 97 (1867), pro parte, quoad specim. Talish.

Paenonia wittmanniana auct. non Hartwiss ex Lindl.: Riedl in Rechinger (ed.), *Fl. Iranica* 60: 4 (1969), pro parte, quoad pl. Persica.

PHENOLOGY. Flowering in May and early June; fruiting in August.

CHROMOSOME NUMBER. $2n = 20$ (Stebbins, 1938a; Punina, 1987, 1989).

HABITAT AND DISTRIBUTION. Growing in deciduous forests with sand soils, at altitudes from 1170 to 2,740 m. We also found this subspecies growing on a pasture with scattered trees or shrubs. Confined to the Talish Mountains of Azerbaijan and N Iran, and Elburz Mountains in N Iran (Map 5.20).

DIAGNOSTIC CHARACTERS. The subspecies is characterised by leaflets nearly always densely covered with villose hairs on the lower surface, carpels mostly densely, rarely sparsely, tomentose, or occasionally glabrous, and petals usually pale yellow, rarely pale yellow but reddish at the base. It mostly resembles subsp. *wittmanniana*, but differs in having leaflets mostly densely villose on the lower surface and carpels more-or-less tomentose. By contrast, subsp. *wittmanniana* possesses leaflets that are mostly sparsely villose and carpels that are often glabrous. The two subspecies are geographically isolated by a considerable distance.

ADDITIONAL SPECIMENS EXAMINED. AZERBAIJAN, Lerik: *s. loc.*, 28 July 1975, Y. Menitsky & T. Popova s.n. (LE); Orand, in forests, 21 Aug. 1938, Rzazade s.n. (BAK); Orand, 3 July 1962, T. F. Achundov s.n. (BAK); Orand, 1,500 m, 8 July 1931, I. V. Schipczinsky 652 (BAK); Orand, Zubu, 38°46'N, 48°25'E, 1,170 m, 9 May 1999, D. Y. Hong & S. L. Zhou H99046 (A, CAS, K, MO, PE, US); between Orand and Schinabad, in forests, 13 May 1946, Grossheim s.n. (BAK); from Orand to Schinabad, 14 June 1979, Y. Menitsky & T. Popova, 14 (LE); Orand Gorge, 5 May 1960, Gusev 109 (LE); near Schinabad, 11 May 1946, Grossheim s.n. (BAK); between Schinabad and Lenkoran, 5 May 1960, Achundov & Sulejmanov s.n. (BAK); between Schinabad and Lulekeran, 5 May 1960, Mordak 251 (LE); near Lerik, 24 July 1963, A. E. Bobrov & N. N. Tzvelev 893 (LE); near Lerik, in forests, 14 May 1935, Grossheim s.n. (BAK, LE); *loc. eodem*, 4 May 1946, Irinskai & Kirpichnikov s.n. (LE); between Lerik and Lule-Keran, 9 July 1968, L. Kuzmina & N. Trukhaleva s.n. (LE); between Lerik and Buzagar, 1,700 m, 3 July 1931, Schipczinsky 513 (LE). **Lenkoran:** between Alasapin and Nadus-Galasi, 12 July 1929, Prilipko s.n. (BAK); near Lenkoran, in forests, May 1838, Hohenacker s.n. (BM, E, G, K, US). **IRAN, Gilan:** Asalem to Khalkhal, above Sefid Poshteh, 1,900–2,100 m, 17 July 1975, P. Wendelbo & M. Assadi 18544 (W). **Gorgan (Astrabad):** Siaret, Apr. 1858, Bunge s.n. (K, P); *loc. eodem*, May 1858, Bunge s.n. (K, P); Elburz Mountains, 1,830 m, 1907, R. B. Woosnaw s.n. (BM); *s. loc.*, May 1948, Sharif 534 (W); Golestan National Park, 30 May 1975, Firuz-Nia 1178 (W); *loc. eodem*, 9 Aug. 1962, Abai 12657 (W); *loc. eodem*, c. 8–12 km N of Dashte-shad, 1,500–1,700 m, 2 July 1988, Akhani 4381 (M); Sharbat, between Gorgan and Ziarat, 28 Apr. 1935, Gauba 4 (W); Golistan Valley, Mohammad Reza Shah Wild Life Park, 1,250–1,400 m, 30 July 1974, P. Wendelbo & Cobham 14322 (W). **Mazandaran:** Chalus Valley, above Siah Bisheh, 2,200 m, degraded forests, 23 May 1974, P. Wendelbo & Shirdelpur 11668 (E, W); Dimalu, 2,740 m, 22 July 1940, W. Koelz 16510 (US).

20f. *Paeonia daurica* subsp. *velebitensis* D. Y. Hong, subsp. nov.

Nova subspecies a aliis subspeciebus *Paeonia dauricae* foliolis subtus dense villosis et sepalis saepe extus pilosis dissimilis. TYPE: Croatia, Velebit, Mt Kiza, Ostaria, 12 June 1907, J. B. Kümmerle s.n. (holotype here designated, BP!) (Fig. 5.20C).

DIAGNOSTIC CHARACTERS. The present author examined 11 collections with 12 sheets in the Hungarian Natural History Museum (BP), the Conservatoire et Jardin botaniques de la Ville de Geneve (G), the University of Vienna (WU) and the Botanic Garden in Munich (M). In these collections, all lower leaves are biternate, with 9 leaflets, which are obovate, rarely oblong-elliptic, rounded to acute at the apex, rather densely villose beneath. The carpels are 2 or 3 in number, tomentose, with hairs 3 mm long. These characters indicate the position of these collections within *Paeonia daurica* Andrews. The character states of 9 leaflets on lower leaves with obovate shape, mostly rounded apex, and rather densely villose hairs beneath make them distinctly different from



Fig. 5.20C. *Paeonia daurica* subsp. *velebitensis* D. Y. Hong: **a**, a lower leaf; **b**, the young carpels with an involucrate bract and sepals; **c**, the lower surface of a leaf, showing villose hairs. Drawn by Mr SUN Yin-Bao.

P. mascula (leaflets/leaf segments of lower leaves more than 9, ovate or oblong-elliptic, acute at the apex, glabrous or sparsely hispid beneath).

NOTES. The peony in Velebit of Croatia is characterised by villose calyx and rather dense villose hairs on the lower surface of leaves. It is similar to subsp. *tomentosa* (Lomakin) D. Y. Hong, which is found in S Azerbaijan and NE Iran (the Talish Mountains and Elburz Mountains), but subsp. *tomentosa* has yellow petals. The sepals of subsp. *velebitensis* are often villose, and thus different from all other subspecies of *Paemonia daurica*. Therefore, the peony in the Velebit Mountains is rather distinct in morphology from the other six subspecies. Nevertheless, we place it here as a subspecies because its leaf pattern and shape are very similar to those of the typical subspecies, and because we have limited knowledge relating to this peony. The subspecies is confined to the Velebit Mountains in Croatia, and is found at an altitude of 900–1,150 m.

ADDITIONAL SPECIMENS EXAMINED. CROATIA, Velebit Mts: above Mickovica, 19 June 1909, *J. B. Kümmerle* 313 (BP); Lika-Krbava, Ostaria, Mt Sladovaca, 13 June 1907, *J. B. Kümmerle* s.n. (BP); Ostaria, Mt Sladovaca, 45°14'N, 15°15'E, 13 June 1906, *J. B. Kümmerle* s.n. (G); Ostaria, 1,150 m, 3 July 1911, *Filarszky & J. B. Kümmerle* s.n. (BP); Mt Bacickosa, 1,000 m, 22 June 1937, *L. Vajda* s.n. (BP); Mt Bacickosa, N of Karlobag, 900 m, 31 May 1966, *D. Podlech* 13237 (M); Mt Bacickuk, 1,100 m, 27 May 1938, *L. Vajda* s.n. (BP); *loc. eodem*, 1,000 m, 26 May 1938, *L. Vajda* s.n. (BP); Kuk, 12 July 1919, *I. Pevalek* s.n. (WU); Velinac(?), 1,000 m, 31 June 1966, *J. Grau* s.n. (M).

20g. *Paemonia daurica* subsp. *wittmanniana* (Hartwiss ex Lindl.) D. Y. Hong in Hong & Zhou, *J. Linn. Soc. Bot.* 143: 146 (2003). *Paemonia wittmanniana* Hartwiss ex Lindl., *Bot. Reg.* 32: tab. 9 (1846); Ruprecht, *Mem. Acad. Imp. Sci. St-Petersburg*. ser. 7, 15(2) (*Fl. caucasi*): 46 (1869); Huth, *Bot. Jahrb. Syst.* 14: 266 (1891), pro parte, excl. specim. Djichis-Djarai; Schipczinsky in Komarov, *Fl. USSR* 7: 29 (1937); Stern, *Study Gen. Paemonia*, 56 (1946); Grossheim, *Fl. Kavkaza* 4: 12 (1950); Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 17 (1961). TYPE: Lindley's tab. cited (holotype!). *Paemonia abchasica* Misch. ex Grossh., *Fl. Kavkaza* 2: 92 (1930); Schipczinsky in Komarov, *Fl. USSR* 7: 33 (1937). TYPE: Abchasia, Tsebelde, 16 May 1904, *G. Woronow* s.n. (neotype here designated, LE!; isoneotypes G!, M!).

Paemonia corallina Retz. var. *wittmanniana* (Steven) Albov, *Prodr. Fl. Colchic.*, 14 (1895), pro parte, quoad pl. Abchasia.

PHENOLOGY. Flowering from late April to May; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 20$ (Barber, 1941; Punina, 1987, 1989; Stebbins, 1938a; Stern, 1944).

HABITAT AND DISTRIBUTION. Growing in deciduous forests and alpine or subalpine meadows at altitudes of (800)–1,500–2,300 m. All the available records of herbarium specimens show that it is confined to limestone areas. Confined to NW Georgia (Abchasia, Imereti, Megrelia, Ratsha-Letskhumu and Svaneti) and the adjacent region of Russia (upper reaches of the Mzymta River) (Map 5.20).

NOTES. We were unable to visit the localities of this subspecies when we were in Georgia in 1999 because of security considerations. Nevertheless, we have examined a large number of herbarium specimens and live individuals in the Tbilisi and Bakuriani Botanical Gardens in Georgia. These showed that the leaflets of this subspecies varied from glabrous to sparsely villose beneath, carpels were 1–3 in number and varied from glabrous or sparsely villose to tomentose, and petals varied from yellow to yellow with a pink spot at the base. The entity is not sufficiently distinct from its closest relatives to allow specific status.

ADDITIONAL SPECIMENS EXAMINED. GEORGIA, Abchasia: Gagra, near Guzlia, Mt Berchil, limestones, 28 June 1989, *D. Geltman et al.* 3109 (LE); *loc. eodem*, 12 km NE of Gagra, 27 June 1989, *D. Geltman et al.* 3193 (LE); *loc. eodem*, Fagus–Abies forests, 27 June 1989, *D. Geltman et al.* 3241 (LE); Gagra, Dzhoviahu Mountain Range, 16 Apr. 1913, *Sakharov* 957 (LE); Gagra, path to Ritsa

Lake, Gegi River Valley, 17 May 1940, *Komarov* s.n. (LE); Himtsa, 19 May 1928, *Zakharova* 958c (LE); Sukhumi Region, Mt Ahupach, Tsebelda (Zebelda), Apr. 1904, *O. Woronowa* s.n. (G, LE, US); Tsebelda, 4 May 1904, *G. Woronow* s.n. (LE, WU); between Tsebelda and Amtkal, 21 Apr. 1947, *Yabrova* s.n. (LE); Tschernomore, 8 May 1923, *Steup* s.n. (LE); Mt Bzipi, 800 m, 13 July 1958, *Sochadze* s.n. (TBI); Mt Bzipi, near Ritsa, 22 May 1948, *Purtskvanidze* s.n. (TBI); Predbzybsky Mountain Range, alpine meadows, 1,800 m, 30 June 1936, *Paniutin* 958a (LE); Bzybsky Mountain Range, Mt Pshechishho, 1,700–1,750 m, 1 Aug. 1930, *Petiaev* s.n. (LE); Bzybsky Mountain Range, Mt Khou, Heczigware Valley, 1,850 m, 2 Oct. 1893, *N. Albov* 430 (G); *loc. eodem*, 1,800 m, 3 Oct. 1893, *N. Albov* 289 (G); east end of Bzybsky Mountain Range, Abats, 1,800–1,900 m, 20 Aug. 1990, *Dolmatova et al.* 935 (LE); Mt Mamdzyshkha, alpine pastures, 1,900 m, 8 July 1905, *G. Woronow* 191 (G, LE); Mt Dzyshra, subalpine meadows, 21 July 1929, *A. & A. Fedorov* s.n. (LE); Mt Massivum, limestones, 20 June 1980, *Davlianidze & Kapanadze* 1434 (TBI); upper reaches of Kodor River, near Sakeni, 2 July 1964, *Mordak* s.n. (LE); Joekbara, 20 July 1945, *Kemularia-Nathadze* s.n. (TBI); *loc. eodem*, 10 May 1902, *G. Woronow* s.n. (LE). **Imereti:** Kutais, Mt Vakerali, 20 July 1929, *Kemularia-Nathadze* s.n. (TBI); upper part of Kvirila, NW of Perevi, 31 July 1955, *Dolukhanov & Kazarova* s.n. (TBI). **Megrelia:** Okhachku, 2 July 1958, *M. Sochadze* s.n. (TBI); *loc. eodem*, 1,500 m, 30 June 1958, *M. Sochadze* s.n. (TBI); *loc. eodem*, 1,600 m, 30 June 1958, *M. Sochadze* s.n. (TBI); *loc. eodem*, 1,300 m, 6 July 1958, *M. Sochadze* s.n. (TBI); Mt Okhachku, limestones, 1,600–1,800 m, 27 Aug. 1987, *Adzinba & Chitanova* s.n. (LE); Siniagvar, 1,600 m, 18 May 1937, *Zakharova* 957c (LE); Mt Dzhwari, 2,000 m, 25 Aug. 1893, *N. Albov* 607 (G); *s. loc.*, 2,000 m, 25 July 1956, *E. & M. Sochadze* s.n. (TBI). **Ratsha-Letskhumi:** Mt Massivum, limestones, 1,700 m, 18 July 1980, *Davlianidze* 1460 (TBI); Mt Khvamli, 840 m, 4 Nov. 1925, *Meffert* s.n. (LE); *loc. eodem*, 18 July 1980, *Gviniashvili* s.n. (LE); Mt Khvamli, 15 June 1958, *Kemularia-Nathadze et al.* s.n. (TBI); *loc. eodem*, 1,400 m, 6 July 1957, *M. Sochadze* s.n. (TBI); *loc. eodem*, 1,600 m, 6 Aug. 1955, *M. Sochadze* s.n. (TBI); *loc. eodem*, 1,780 m, 6 July 1957, *M. Sochadze*, s.n. (TBI); Shkmeri, Kvagakhetkia, 1,700 m, 23 Aug. 1968, *s. coll.*, s.n. (TBI); near Tsageri, top of Kulus, Nov. 1927, *Meffert* s.n. (LE); Shovi River, 17 June 1965, *R. Gagnidze et al.* s.n. (TBI). **Svaneti:** Tsana, 1,700–1,800 m, 21 July 1978, *Mukhaniani et al.* s.n. (TBI); Mt Koruldani, 5 May 1964, *Serdjukov* s.n. (TBI); near Kakhura, Goldashi, 2,300 m, 12 July 1979, *Mukhaniani et al.* s.n. (TBI); Lentekhi, Skileri River, upper reaches, 22 July 1979, *G. Zamtaradze* s.n. (TBI). **Tbilisi:** Tbilisi Botanical Garden, introduced from Tsebelda, Abchasia, 3 May 1923, *A. Woronowa* s.n. (LE); the same garden, introduced from Abchasia, 1 May 1999, *D. Y. Hong & S. L. Zhou* H99025 (PE) and 23 May 1999, *D. Y. Hong & S. L. Zhou* H99068 (PE). **Borjomi:** the Bakuriani Botanical Garden, introduced, 19 May 1999, *D. Y. Hong & S. L. Zhou* H99063 (PE). **RUSSIA:** Caucasus Nature Reserve: right bank of Mzymta River, Ahtsu Gorge, 29 Apr. 1989, *Lebedeva* s.n. (LE); upper reaches of Mzymta River, Sochi region, in *Fagus* forests, 23 Sep. 1984, *Solodko* s.n. (LE).

21. *Paeonia mascula* (L.) Mill., *Gard. dict.* edn 8, 1 (1768); Gürke in Richter, *Pl. eur.* 1: 400 (1903), pro parte, excl. var. *triternata*; Stern, *J. Roy. Hort. Soc.* 68: 126 (1943); Stern, *Study Gen. Paeonia*, 67 (1946), pro parte, excl. pl. Armenia and Azerbaijan; Cullen & Heywood, *Feddes Repert.* 69: 35 (1964), pro parte, excl. subsp. *arietina*, Cullen & Heywood in Tutin *et al.* (eds), *Fl. Europ.* 1: 244 (1964), pro parte, excl. subsp. *arietina*; Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 293 (1993), pro parte, excl. subsp. *arietina* and subsp. *triternata*; Phitos in Strid & Kit Tan, *Fl. Hellenica* 2: 78 (2002), pro parte, excl. subsp. *triternata*. *Paeonia officinalis* β *mascula* L., *Sp. pl.* 1: 530 (1753); Martyn, Miller & Martyn, *Gard. Dict.* edn 9, 2(2) (1807). *Paeonia officinalis* L. subsp. *corallina* (Retz.) Fiori var. *mascula* (L.) Fiori in Fiori & Paoletti, *Fl. Italia* 1(2): 527 (1898). TYPE: “*Paeonia mas altera*, quae tardier J. B. 3. 492”, n° 211. 1. A (lectotype designated by Schmitt, 2003: *Clifford Herbarium* n.v.; photo, BM!). Epitype: France, Beaune (Côte d’Or), 400 m, 24 May 1911, *Vergnes* s.n. (designated by Schmitt 2003: P!).

Paeonia corallina Retz., *Observ. bot.* 3: 34 (1783); Anderson, *Trans. Linn. Soc. London* 12: 268 (1818); de Candolle, *Syst. nat.* 1: 388 (1818) and *Prodr.*, 1: 65 (1824); Reichenbach, *Fl. germ. excurs.* 2: 752 (1832) and *Icon. fl. germ. helv.* 4: 28, tab. 4745 (1840); Koch, *Syn. fl. germ. helv.*, 26 (1837); Boissier, *Fl. orient.* 1: 97 (1867), pro parte, excl. var. *triternata*; Amo y Mora, *Fl. fan. Penins. Iberica* 5: 745 (1873), quoad. nom.; Cosson, *Comp. fl. atlant.* 2: 52 (1887); Lynch, *J. Roy. Hort. Soc.*, 12: 436 (1890); Huth, *Bot. Jahrb. Syst.* 14: 267 (1891), pro parte, excl. var. *broteri* and var. *cambessedesii*; Rouy & Foucaud, *Fl. France* 1: 143 (1893), pro parte, excl. *P. corsica*, *P. ovatifolia* and *P. triternata*; Hegi, *Ill. Fl. Mitt.-Eur.* 3: 455, fig. 635 (1909), pro parte, excl. pl. Kreta. *Paeonia officinalis* L. subsp. *corallina* (Retz.) Fiori in Fiori & Paoletti, *Fl. Italia* 1(2): 527 (1898), pro parte, quoad var. *mascula*. TYPE: France, near Clermont-Ferrand, Chadieu, 30 Apr. 2001, A. Fridlender H01004 (neotype here designated, PE!; isoneotypes A!, CAS!, BM!, K!, MO!, P!).

Paeonia integra J. A. Murray, *Comm. Gotting.* 7: 92 (1786). TYPE: not designated.

Paeonia integrifolia Link, *Enum. Hort. Berol.* 2: 77 (1822), err. pro *P. integra* J. A. Murray.

Paeonia mas Garsault, *fig. pl. med.* 2: 259, pl. 435A (1764), nom. illeg.

Paeonia mascula L. ex Desf., *Tabl. école bot.*, 126 (1804), nom. illeg.

Paeonia mascula L. ex Beck, *Fl. Nieder-Österreich* 1: 393 (1890), nom. illeg.

Herbs perennial up to 80 cm tall. Roots always carrot-shaped. Stems usually green, sometimes purple, always glabrous, up to 1 cm in diameter. Lower leaves biternate with some leaflets segmented; leaflets/leaf segments usually 11–18, rarely less or more, up to 21 in number, ovate, obovate, wide-elliptic or oblong, cuneate or rounded-cuneate at the base, acute at the apex, 4.5–18 cm long, 3–9 cm wide, glabrous above, mostly glabrous, less frequently sparsely, rarely rather densely hispid beneath. Flowers solitary and terminal; involucrate bracts 1–2 in number, leaf-like; sepals 3–4 in number, all rounded or only one acute at the apex, purple or purple at the periphery, glabrous, 1.5–3 cm long, 1–2.5 cm wide; petals 7–9 in number, pink, red, white or white with pink shade at the base or periphery, obovate, rounded at the apex, 5–7 cm long, 2.5–4 cm wide; filaments pink to purple; anthers yellow; disk waved, 1 mm high, tomentose; carpels mostly 3–4, rarely 1–2, occasionally more in number, always lanate, hairs 3 mm long; styles absent or 1 mm long; stigmas 2–2.5 mm wide, red. Follicles ovoid-columnar. Figs 5.21A, 5.21B.

CHROMOSOME NUMBER. $2n = 20$ (see each subspecies for detail).

DISTRIBUTION. Relatively widely distributed, from N Spain (Cantabria and Soria) to Iraq via France, Italy, the Balkans, Cyprus and Turkey (Map 5.21).

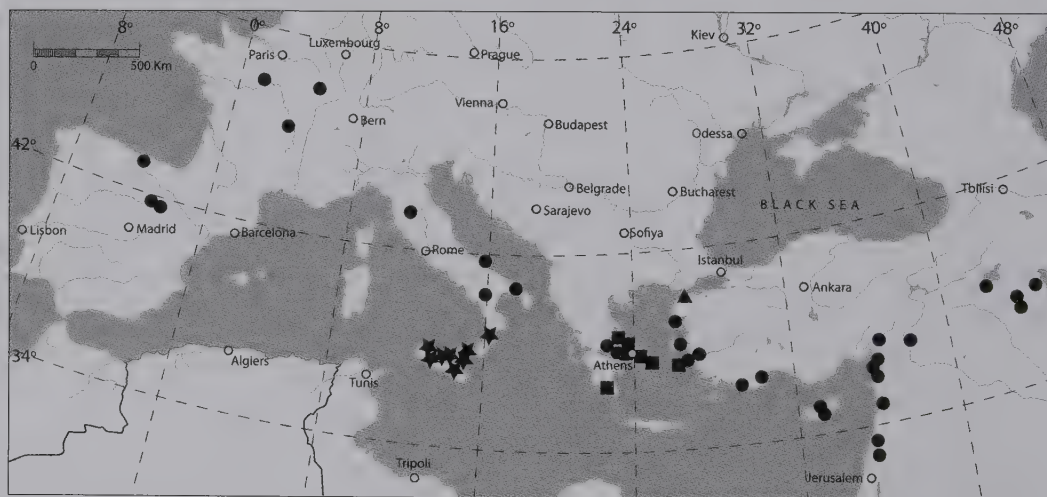
NOTES. The circumscription of *Paeonia mascula* has changed greatly. Cosson (1887) adopted a very broad concept of *P. corallina* (= *P. mascula*), including *P. broteri*, *P. cambessedesii*, *P. coriacea*, *P. russoi* and *P. coriacea* var. *atlantica* (= *P. algeriensis* Chabert). Gürke (1903) used the name *P. mascula* (L.) Desf. (*Tabl. école bot.*, 126 (1804)), but his concept is similar to Cosson's (1887). However, Lynch's (1890) *P. corallina* excluded *P. broteri*, *P. coriacea*, *P. triternata* (= *P. daurica*) and *P. russoi* as separate species. Huth (1891) held a broad concept following Cosson (1887), and thus broad concepts were prevalent until Stern's (1946) monograph. Fiori (1898) developed an even broader concept for this group, treating *P. corallina* as a subspecies of *P. officinalis*, and *P. mascula* as a variety of this subspecies, i.e. *P. officinalis* subsp. *corallina* var. *mascula*, but his treatment has never been accepted. Stern (1943, 1946) gave *P. mascula* a narrow sense, recognising the *Arietina* group (including *P. arietina* and *P. bakeri*), the *Broteri* group, the *Coriacea* group (*P. coriacea* and *P. coriacea* var. *atlantica*) and the *Russoi* group (*P. russoi* and *P. cambessedesii*) as groups allied to the *Mascula* group (*P. mascula*, *P. daurica*, *P. banatica* and *P. kesrouanensis*).

Cullen and Heywood (1964a, 1964b) revised the taxonomy of the genus *Paeonia* in Europe, treating *P. russoi* Biv. as a subspecies in *P. mascula*, and merging *P. arietina* G. Anderson for the first time into *P. mascula* as a subspecies, *P. mascula* subsp. *arietina* (G. Anderson) Cullen & Heywood. Thus, the species then had three subspecies. This circumscription was accepted by Davis and Cullen

(1965b) in 'Flora of Turkey'. Bolòs and Vigo (1974) adopted Cosson's (1887) viewpoint, treating *P. cambessedesii* as a subspecies within *P. mascula* but no one has subsequently followed this treatment. Tzanoudakis (1977, 1983) adopted Cullen and Heywood's (1964a) concept and described two new subspecies within *P. mascula*, i.e. subsp. *hellenica* and subsp. *icarica* (Tzanoudakis, 1977). Greuter and Burdet (1982) treated the plant from Algeria as *P. mascula* subsp. *atlantica* (Coss.) Greuter and Burdet (= *P. algeriensis* Chabert, = *P. corallina* var. *atlantica* Coss. = *P. coriacea* var. *atlantica* (Coss.) Stern). Stearn and Davis (1984) basically adopted Cullen and Heywood's (1964a) concept, but treated *P. daurica* Andrews (1807c) as a subspecies within *P. mascula*, *P. mascula* subsp. *triternata* (Pall. ex DC.) Stearn & P. H. Davis. Muñoz-Garmendia and Navarro (1993) recorded *P. mascula* subsp. *mascula* in the Iberian Peninsula for the first time. Akeroyd (1993) basically followed Cullen and Heywood (1964a), Tzanoudakis (1977), and Stearn and Davis (1984), in recognising five subspecies: subsp. *mascula*, subsp. *arietina*, subsp. *hellenica*, subsp. *russoi* and subsp. *triternata*. *Paeonia mascula* subsp. *bodurii* N. Özhatay was described as new from NW Turkey (Çanakkale Province) by N. & E. Özhatay (1995). Schmitt (1997) recognised five subspecies in *P. mascula*: subsp. *mascula*, subsp. *atlantica*, subsp. *coriacea* (Boiss.) Malagarriga (1975), subsp. *hellenica* and subsp. *russoi*, failing to mention subsp. *arietina*, subsp. *bodurii* and subsp. *triternata*. Halda (1997, 2004) gave no reasons when he merged *P. kesrouanensis* Thiébaud into *P. mascula* as a subspecies.

It is clear from the above historic review of taxonomic treatments of *P. mascula* and its allies that there were 10 valid subspecific names before Hong *et al.* (2005, 2007), subsp. *mascula*, subsp. *arietina*, subsp. *atlantica*, subsp. *bodurii*, subsp. *coriacea*, subsp. *hellenica*, subsp. *kesrouanensis*, subsp. *orientalis*, subsp. *russoi* and subsp. *triternata*.

Our observations of sampled populations and herbarium specimens, and subsequent analysis, show that *P. daurica* Andrews (= *P. mascula* subsp. *triternata*) is an independent species (Hong *et al.*, 2007). It has mostly nine leaflets or segments and is a diploid, with the exception of three subalpine or alpine subspecies in the Caucasus (Hong & Zhou, 2003). *Paeonia algeriensis* Chabert (1889) is a distinct species with mostly single and nearly always glabrous carpels, large follicles and always villose lower leaf surfaces (see that species for a detailed analysis). *Paeonia arietina* has its closest relatives in the *P. officinalis* group rather than the *P. mascula* group because it has tuberous roots and densely hirsute stems, leaves and sepals (Hong *et al.*, 2008). Hong and Wang (2006) demonstrated that the peonies in Corsica, in Sardinia and on the Ionian Islands and the adjacent mainland (Akarnania Province of Greece), which have been identified as *Paeonia* subsp. *russoi*, do not belong to this subspecies but form an independent



Map 5.21. Distribution of *Paeonia mascula* (L.) Mill.: black circles = subsp. *mascula*; squares = subsp. *hellenica*; stars = subsp. *russoi*; triangles = subsp. *bodurii*.

species, *P. corsica* Sieber ex Tausch (1828). According to their concept, subsp. *russoi* is confined to Sicily and Calabria in Italy. *Paeonia coriacea* Boiss. is distinct and can be readily distinguished from *P. mascula* as it is glabrous throughout, its styles 1.5–3 mm long, and its carpels mostly 2 in number. *Paeonia kesrouanensis* (Thiébaud) Thiébaud differs distinctly from *P. mascula* in always having glabrous carpels, in having leaves that are rather densely villose beneath, and in having styles and stigmas that are 5–7 mm long in total, and recurved at the apex. *Paeonia kesrouanensis* and *P. mascula* meet in S Turkey (Hatay Province), but we found no hybrids there during our field observations in 2002, indicating that the two species are indeed distinct (Hong *et al.*, 2005).

Paeonia mascula here circumscribed is a variable species. According to our observations and statistical analysis, four subspecies could be recognised in its entire range.

- 1a. Flowers red or pink (entire range, except Sicily, Calabria, Çanakkale Province of Turkey and some Aegean islands) 21a. subsp. *mascula*
- 1b. Flowers mostly white, rarely red or pink.
 - 2a. Leaves nearly always hispid, very rarely glabrous beneath (Sicily and Calabria of Italy) 21d. subsp. *russoi*
 - 2b. Leaves mostly glabrous, rarely very sparsely hispid beneath.
 - 3a. Leaflets/leaf segments of lower leaves 9–11 in number, 13–17.5 × 7–9 cm (Çanakkale in NW Turkey) 21b. subsp. *bodurii*
 - 3b. Leaflets/leaf segments of lower leaves (9–)11–14(–21) in number, 9–13 × 4.5–7.5 cm (S Greece and Aegean islands) 21c. subsp. *hellenica*

21a. *Paeonia mascula* subsp. *mascula* Stearn & Davis, *Peonies Greece* 77, fig. 27 (1984); Muñoz-Garmendia & Navarro in Castroviejo *et al.* (eds), *Fl. Iberica* 3: 146, fig. 40 (1993).

Paeonia kavachensis Azn., *Magyar Bot. Lapok* 16: 7 (1917). TYPE: E Turkey, Vastan, Kavache, Tshitouny 187 (holotype ISTE?)

Paeonia kurdistanica Zohary, *Pal. J. Bot. Jer. ser. 2* (2/3): 155 (1941). TYPE: “Iraq: Kurdistan: env. of Sursink, deep shady gorge, 920 m, rocks”, 26 Sep. 1933, *Feinbrun & Schwarz* s.n. (holotype: Herb. Univ. Herbraicae Hierosolynimitanae, n.v.; photo of holotype K!; photo of isotype K!)

Paeonia corallina Retz. var. *orientalis* Thiébaud, *Bull. Soc. Bot. France* 81: 114 (1934) and *Fl. Lib.-Syr.* 1: 37 (1936). *Paeonia arietina* G. Anderson var. *orientalis* (Thiébaud) Stern, *J. Roy. Hort. Soc.* 68: 127 (1943); Stern, *Study Gen. Paeonia*, 83 (1946). *Paeonia mascula* (L.) Mill. subsp. *orientalis* (Thiébaud) D. Y. Hong, *Acta Phytotax. Sin.* 38: 382 (2000), syn. nov. TYPE: Lebanon, Feitroun, 10 Apr. 1932, *Gombault* 3998 (lectotype designated by Schmitt, 2003, P!; isolecotypes BM!, K!, P!).

PHENOLOGY. Flowering from April to May; fruiting in August and September.

CHROMOSOME NUMBER. 2n = 20 (Barber, 1941; Stern, 1944; Tzanoudakis, 1983; the present work with the voucher: Turkey, Hatay, D. Y. Hong *et al.* H02211 (MO, PE)).

HABITAT AND DISTRIBUTION. Growing in deciduous broad-leaved forests dominated by *Quercus*, *Fagus*, *Platanus* or *Castanea*, or in conifer forests of *Pinus*, *Abies* or *Cedrus*, or in thickets at the edges of forests. It is mostly found on limestone areas at altitudes from 300 to 2,200 m. Most widely distributed, covering nearly the entire range of the species, from N Spain to Iraq (absent from Sicily and Calabria of Italy, and some islands in Greece) (Map 5.21). There are some specimens collected from the island of Steep Holm, England, but according to Stern (1946) and Clapham and his co-workers (Clapham *et al.*, 1987), the species was introduced and has been naturalised there.

ADDITIONAL SPECIMENS EXAMINED. **CYPRUS, Troodos Mts:** *s. loc.*, F. M. Probyn 1951 (K); *s. loc.*, 13 June 1974, M. Malicky s.n. (G, W); *s. loc.*, 21 June 1880, *Sintenise & Rigo* 352 (LD) and 854 (BM, G); Prodhromos, G. C. Druce & Y. Lodge s.n. (E); Limassol Distr., Mt Khionistra, between Pano Platres and Prodhromos, 1,000–1,950 m, serpentines, 7 May 1986, K. H. Rechinger 61996 (G, MA,



W); Platania, 18 June 1939, *H. Lindberg* s.n. (LD); Mt Papoutsas, NW slopes, above Palé Khorí-Agros Pass, 1,400 m, 21 Apr. 1979, *J. R. Edmondson & M. A. S. McClintock* E2884 (E); Mt Papoutsas, Palekhorí, Nicosia, 1,070 m, 26 Apr. 1959, *P. H. Oswald* 128 (K); Mt Papoutsas, *Quercus alnifolia* forests, 1,400–1,500 m, 9 Apr. 1941, *P. H. Davis* 3067 (E, K); Lagoudhera, 10 Apr. 1972, *H. J. Leep* 74–6 (SA); Limassol, 2 km E of Prodhromos, 16 May 1972, *F. Spitzenberger* 165 (W); Mt Olympus, 1,200–1,500 m, 26 May 1946, *E. W. Kennedy* 1624 (K); above Prodhromos, 1,430 m, *Pinus nigra* forests, 20 May 1941, *P. H. Davis* 3508 (E, K); *loc. eodem*, 1,500 m, pine forests, June 1929, *C. B. Ussher* 61 (K); *loc. eodem*, 11 May 1862, *T. Kotschy* s.n. (K); *loc. eodem*, 1,500 m, pine forests, 4 Sep. 1955, *G. E. Mherton* 502 (K); *loc. eodem*, 910 m, pine forests, 24 Apr. 1937, *A. Lyngrassides* 1570 (K).

FRANCE, CÔTE D'OR: *s. loc.*, 1847, *C. Cheignard* s.n. (P); *s. loc.*, 1897, *P. A. Genty* s.n. (P); *s. loc.*, 15 May 1873, *Bennet* s.n. (K); *s. loc.*, 28 Apr. 2001, *A. Fridlender* H01003 (PE); Mt Epagny, 47°30'N, 50°E, 22 June 1826, *G. Desplantes* s.n. (BM); *loc. eodem*, 16 May 1897, *Legrand* s.n. (G, P); *loc. eodem*, 300 m, limestones, 22 May 1837, *G. Desplantes* s.n. (B); *loc. eodem*, 400 m, May 1837, *G. Desplantes* s.n. (B); *loc. eodem*, 23 May 1833, *G. Desplantes* s.n. (B); *loc. eodem*, 20 May 1831, *G. Desplantes* s.n. (B); *loc. eodem*, 22 May 1827, *G. Desplantes* s.n. (B); Beaune, 1830, *Steuvot* s.n. (G); Blois, 1842, *Boreau* s.n. (P); near Chaumes, 13 June 1874, *C. Cheignard* s.n. (K).

LOIR ET CHER: *s. loc.*, 1864, *Daenen* s.n. (G); *s. loc.*, 24 Apr. 1890, *A. Sejourné* s.n. (P); St. Gervais, 20 Apr. 1860, *L. Mathannet* s.n. (B); *loc. eodem*, 1869, *L. Mathannet* s.n. (G); Montils, 20 Apr. 1881, *A. Franchet* s.n. (K); near Blesas, Galliae, in forests, July 1861, *L. Mathannet* s.n. (BM); *loc. eodem*, May 1861, *L. Mathannet* s.n. (BM); Blois, 4 July 1861, *L. Mathannet* s.n. (G); *loc. eodem*, 17 May 1861, *L. Mathannet* s.n. (K); *loc. eodem*, Apr. 1914, *Coste & Segret* s.n. (G).

CLERMONT-FERRAND, 5 km SE of Veyre-Monton, 45°38'N, 3°12'E, 360 m, sparse *Quercus*–*Acer* woods, 24 May 2001, *D. Y. Hong, X. Q. Wang & A. Fridlender* H01030 (PE).

Chadieu, Monton, Veyre-Monton, 4 Apr. 2001, *A. Fridlender* H01004a (PE).

GREECE: Boeotia: Mt Elikon, between Kyriaki and Koukoura, Arvanitsa, 1,100 m, 23 May 1974, *D. Tzanoudakis* 1387 (UPA); Mt Elikon, 800 m, outside of the church, 20 May 1975, *D. Tzanoudakis* 2257 (UPA); Mt Elikon, above Evangelistria, 1,200 m, *Quercus* thickets with *Abies cephalonica*, 22 May 1982, *Jim & Jenny Archibald* 5119 (ATH); Mt Parnassos, 16–17 km SE of Eptalofos Village, 1,200–1,300 m, *Abies cephalonica* forests, 23 May 1982, *E. Stamatiadou* 22724 (ATH).

Hios, Mt Pelineo, above Vikion, 750–950 m, 22 June 1991, *S. & B. Snogerup* 8531 (LD, UPA).

Lesvos: Mitilini, Ajiassos, *Fagus* forests, 14 Apr. 1973, *P. Broussalis* s.n. (ATH); *loc. eodem*, 600 m, in *Castanea sativa* forests, 17 May 1969, *E. Stamatiadou* 6309 (ATH, BM); SW of Ajiassos, E-NE slopes of Mt Olimbos, 750 m, pine woods, 18 May 1969, *E. Stamatiadou* 6334 (ATH); Plomari, 39°02'N, 26°23'E, 4 July 1994, *D. Tzanoudakis* 10894 (UPA).

Samos: Mt Kerketefs, S-SE slopes, 1,000 m, 2 May 1968, *E. Stamatiadou* 2666 (ATH); *loc. eodem*, S-SE slopes of Vigla summit, 1,150–1,200 m, in shrubby places, limestones, 1 May 1983, *E. Stamatiadou* 22715 (ATH); Mt Ambelos, N slopes of Zovrahia summit, 800–1,000 m, in *Pinus* and *Abies* forests with abundant *Pteridium equilinum*, 4 May 1968, *E. Stamatiadou* 2736 (ATH, BM, E); *loc. eodem*, SW of Moni Kourna, N-NE slopes of Lazaros summit, 700–850 m, in pine forests, 29 Apr. 1970, *E. Stamatiadou* 8307 (ATH, BM); Mt Ambelos, c. 700–1,000 m, 10 Apr. 1934, *K. H. & F. Rechinger* 3889 (LD); near Kakoperato, Mt Kerkig, 920 m, pine woods, *P. H. Davis* 1639 (E); Mt Kierki, 5 May 1887, *F. Major* 400 (G).

IRAQ: *s. loc.*, *R. W. Haines* 14 (E); Sarsang, 1,200 m, oak forests, 14 May 1957, *R. W. Haines* 959 (E, K); Sarsang, N slopes of Jara Dagh, 1,050 m, oak forest, 11 June 1958, *E. Chapman* 26370 (K); Mosul (Kurdistan), between Dahuk and Amadiyah, 1,200 m, oak forests, limestones, 12 July 1957, *K. H. Rechinger* 11678 (E, W).

ITALY: Apulia (Puglia), Mt Gargano, 1 km N of Ruggiano, 520 m, 21 Apr. 1964, *H. Hertel* 3708 (GZU).

Florence: Certosa,

Fig. 5.21A (opposite). *Paeonia mascula* (L.) Mill. subsp. *mascula*: **a**, carrot-shaped roots (drawn by Miss LI Ai-Li); **b**, the lower part of the stem; **c**, a lower leaf; **d**, the lower surface of a leaf, showing sparse hispid hairs; **e**, a flower with stamens and petals shed. Drawn by Miss CAI Shu-Qin.

May 1887, Martelli s.n. (B, GZU, WU); *loc. eodem*, 14 May 1870, E. Levier s.n. (WU); *loc. eodem*, Apr. 1877, E. Levier s.n. (WU); *loc. eodem*, in forests, 12 Apr. 1872, S. Sommier s.n. (G); *loc. eodem*, 21 Apr. 1877, W. Barbey s.n. (G); *loc. eodem*, 18 Apr. 1871, Meanpli s.n. (RO); Carthusianum, Apr. 1879, E. Levier s.n. (G); *loc. eodem*, Apr. 1886, E. Levier s.n. (BM, GZU); *loc. eodem*, Apr. 1877, E. Levier s.n. (WU); *loc. eodem*, 19 Apr. 1857, J. Caruel s.n. (K). **Lecce**, edges of forests, 30 Apr. 1881, C. C. Lacaita 5374 (BM). **Potenza**: 1,100 m, 28 May 1933, O. Gavioli s.n. (BM); c. 7 km SE of Potenza, S of Serra la Neviera, 40°33'N, 15°50'E, 1,130 m, limestones, sparse pure oak forests, 7 June 2001, D. Y. Hong, X. Q. Wang & A. Fridlender H01023 (A, CAS, K, MO, PE, UPA); Pollareta, May 1908, O. Gavioli s.n. (BM); Pollareta, 1,000–1,200 m, in forests, 4 May 1927, A. Gavioli s.n. (BAC). **Rasarno**: Sasquale s.n. (RO); Jenora s.n. (RO); in forests, N. A. Pedicino s.n. (RO). **LEBANON**: *s. loc.*, 26 May 1941, G. P. Baker s.n. (K); Feitroun, 11 May 1882, E. Peyron s.n. (G); *loc. eodem*, 3 May 1962, *s. coll.* 12605 (G); *loc. eodem*, 29 May 1930, Gombault 1994 (P); *loc. eodem*, 14 May 1931, Gombault 1889 (P); Aqoura, 31 July 1932, Gombault 1726 (P); Reyform, between Beirut and Faraya, limestones, 21 Apr. 1971, C. C. Townsend 71-89 (K). **PALESTINE**, Northern part, Naba-Laban, 1,300 m, J. E. Dinsmore 20001 (K). **SPAIN**: **Cantabria**: Lebena, Cillorigo-Castro, 460 m, 25 Apr. 1991, C. Aedo s.n. (MA); *loc. eodem*, 470 m, 29 July 1991, C. Aedo s.n. (MA). **Soria**: Noviercas, to Borobia, 1,140–1,150 m, 20 Apr. 1997, J. A. Alejandre, J. A. Arizaleta & J. Benito Ayuso 97-366 (MA); El Royo, between El Royo and del Rincona, 8 June 1991, F. Muñoz-Garmendia & C. Navarro s.n. (MA); Roilamienta, 4 May 1961, A. Segura Zubizarreta s.n. (MA); Espejo de Tera, 1,100 m, *Quercus-Fagus* forests, 8 June 1991, J. Baranda, F. Muñoz-Garmendia, C. Navarro & T. Telleria s.n. (MA); Herreros, San Roque, 1,100 m, 21 May 2000, J. A. Alejandre & M. J. Escalente 00-712 (MA). **SYRIA**, N Syria, Mar. 1881, Kessab s.n. (G); N Syria, Kurd dagh, 1,220–1,520 m, May 1907, M. Haradjian 1103 (G); Am Aramie, 8 July 1935, P. Mousterde 4343 (G); Slenfi, 1,600 m, in *Cedrus* forests, 13 Sep. 1952, H. Pabot s.n. (G); Slenfi, Mt Maltai, 25 July 1955, H. Pabot s.n. (G); *loc. eodem*, in forests, 14 July 1956, H. Pabot s.n. (G); Mt Cassius, 11 May 1945, F. H. Norris s.n. (BM); Mt Amanus, Apr. 1906, M. Haradjian 537 (G). **TURKEY**: **Adana**: Bahce, Dumanli Dag, above Haruniye, *Fagus orientalis* forests with *Helleborus vesicarius*, 1,300 m, 19 Apr. 1957, Davis & Hedge D26879 (ANK, BM, K); Haruniye, E-NE of Kurtlar, 1,250 m, *Fagus* forests, 2 May 1952, H. Demiriz 929 (E). **Antalya**: Gebiz (Pisidia), *Abies*, *Acer* and *Quercus* forests, 26 July 1949, P. H. Davis 15711 (K); Kemer (Lucia), Teke Dagh 1,100–1,200 m, in *Quercus coccifera* and *Q. libani* scrubs, 12 July 1949, P. H. Davis 15199 (E, K); Kemer, Tahtali Dag, Kizilalan, *Cedrus libani* forests, 1,000 m, 4 May 1979, H. Pesman & A. Güner 4670 (ANK).

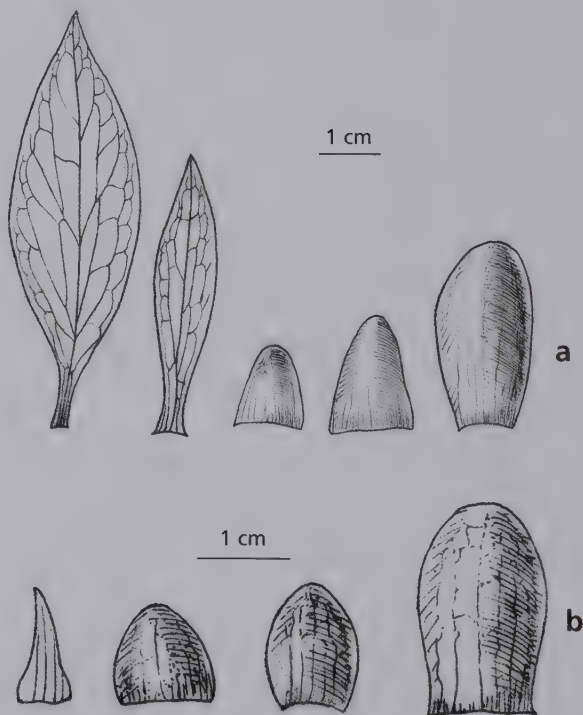


Fig. 5.21B. *Paeonia mascula* (L.) Mill.: involucre bracts and sepals. Drawn by Mr SUN Yin-Bao. **a**, subsp. *mascula*, based on A. Fridlender H01004 (PE); **b**, subsp. *bodurii* based on D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02203 (A, CAS, K, MO, PE, UPA).

Bitlis: S slopes of Kambos Dag, above Tutu, 2,000 m, under oak scrubs near tree line, 17 Aug. 1956, McNeil 621 (E, K); Kotum, Karz Dag, above Kamer, 2,200 m, limestones, 24 Aug. 1954, P. H. Davis & O. Polunin 24603 (ANK, BM); *s. loc.*, June 1966, P. H. Davis 46082 (K). **Hakkari:** below Oramar, 1,300 m, in shade of *Platanus orientalis* and *Castanea sativa*, 17 May 1978, J. Trelawny & J. McPhail 2031 (E); 9–10 km from Semdinli to Yüksekova, 1,700–1,800 m, in oak woods, 16 June 1966, P. H. Davis 45045 (E). **Hatay:** Senkoy, Ziyaret Hill above Senkoy, 1,180 m, limestones, 17 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02211 (MO, PE); Belen, above Güzelyayla, N slopes, 930 m, limestones, oak scrubs, 17 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02212 (PE); Antakya, 5–8 km SW of Senkoy, 1,000 m, *Quercus coccifera* maquis, 28 Apr. 1957, Davis & Hedge D27159 (BM, K); Mt Amanus, Köstelli-Kouph Or. mont, 14 Apr. 1967, Y. Ahman 138 (E); Mt Amanus, 1906, M. Haradjian 238 (G). **Izmir:** N side of Samsun Dag, above Güzelcamli, 200–400 m, mixed forests, 24 Apr. 1965, P. H. Davis 41775 (E, K). **Konya,** Seydisehir, Fevzine, *Quercus* forests, 1,300 m, 18 May 1982, H. Ocakverdi 1289 (ANK). **Mugla,** Baba Dag, 1,250 m, woodlands, 8 May 1990, Turland 307 (BM).

21b. *Paeonia mascula* subsp. *bodurii* N. Özhatay in Özhatay & Özhatay, *Karaca Arb. Mag.* 3(1): 21, figs 3–5 (1995). TYPE: NW Turkey, Çanakkale: Çan-Çanakkale, above Camyayla, 760 m, 29 Apr. 1992, S. Bodur ISTE 64073 (holotype ISTE, n.v.; isotype MARA).

PHENOLOGY. Flowering in late April and May.

CHROMOSOME NUMBER. $2n = 20$ (Özhatay & Özhatay 1995, the present work with the voucher: Turkey, Çanakkale, D. Y. Hong *et al.*, H02203 (A, CAS, K, MO, PE, UPA)).

HABITAT AND DISTRIBUTION. Growing in sparse forests of *Quercus infectoria*, *Pinus nigra*, *Tilia* sp. and *Castanea sativa* on stony slopes. Not far away from the population (H02203) we sampled was a pure and well-developed *Pinus nigra* forest. It is apparent that the habitat of *Paeonia mascula* subsp. *bodurii* is secondary. It was found on granites at an altitude of 400–760 m. According to N. & E. Özhatay (1995) and our observations, the subspecies is confined to a small area near Camyayla in Çanakkale Province, NW Turkey (Map 5.21).

DIAGNOSTIC CHARACTERS: This subspecies is characterised by white petals, and by fewer but larger leaflets/leaf segments (9–11 in number; terminal one 13–18 cm long, 7–9 cm wide) than in subsp. *mascula*.

ADDITIONAL SPECIMEN EXAMINED. **TURKEY, Çanakkale,** Çan-Çanakkale, near Camyayla, 620 m, granites, 12 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02203 (A, CAS, K, MO, PE, UPA).

21c. *Paeonia mascula* subsp. *hellenica* Tzanoud., *Cytotax. Study Gen. Paeonia in Greece*, 36 (1977); Stearn & Davis, *Peonies Greece*, 95 (1984); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 294 (1993); Phitos in Strid & Kit Tan, *Fl. Hellenica* 2: 80 (2002). TYPE: Greece, Isl. Euboea, Kerasovrysi, Steni, 600 m, 4 May 1974, D. Tzanoudakis 1210 (holotype UPA!).

Paeonia mascula (L.) Mill. subsp. *icarica* Tzanoud., *Cytotax. Study Gen. Paeonia in Greece*, 38 (1977); Phitos in Strid & Kit Tan, *Fl. Hellenica* 2: 80 (2002). *Paeonia mascula* (L.) Mill. subsp. *hellenica* Tzanoud. var. *icarica* (Tzanoud.) Stearn & Davis, *Peonies Greece*, 96 (1984), syn. nov. TYPE: Greece, Isl. Ikaria, prope pagum Monocampion, c. 600 m, 23 Apr. 1975, D. Tzanoudakis 2215 (holotype UPA!).

PHENOLOGY. Flowering from April to middle May; fruiting in August.

CHROMOSOME NUMBER. $2n = 20$ (Tzanoudakis, 1977, 1983; Hong *et al.*, unpublished, the voucher: Greece, Euboea, D. Y. Hong *et al.* H02226 (A, BM, CAS, K, MO, P, PE)).

HABITAT AND DISTRIBUTION. Found mostly in forests dominated by *Abies* and *Arbutus*, or in sparse

Crataegus thickets with scattered trees of *Castanea sativa*, *Platanus orientalis*, etc.; on limestones at an altitude of 500–2,000 m. Confined to S Greece and the Aegean islands (Map 5.21).

DIAGNOSTIC CHARACTERS. Flowers of this subspecies are mostly white, rarely red or pink. According to Dr Tzanoudakis at the University of Patras, Greece (on the evidence of his slides of a population from Euboea), 90% of individuals have white petals. It is closely related to subsp. *russoi*, from which it differs only in having leaves mostly glabrous, rarely sparsely hispid on the lower surface.

ADDITIONAL SPECIMENS EXAMINED. GREECE, Andros: Mt Kouvari, 600–750 m, 5 Apr. 1970, *E. Stamatiadou* 7778 (ATH, BM); *loc. eodem*, 2 Apr. 1971, *S. Snogerop* & *M. Gustafsson* 50641887 (LD); Cyclades, *M. Young* 53H (K); Arnas, Mt Kouvara, W slopes, 600–850 m, *Quercus pubescens*–*Acer sempervirens* thickets, 23 Apr. 1975, *E. Stamatiadou* 18328 (ATH, BM). **Attica:** Mt Parnes, N side, 700 m, in *Abies*–*Arbutus* forests, 11 May 1976, *W. T. Stearn* s.n. (BM); *loc. eodem*, c. 700 m, 12 May 1976, *W. T. Stearn* s.n. (BM); Mt Parnes, 21 May 1895, *T. de Heideich* s.n. (WU); *loc. eodem*, May 1934, *F. Guiol* 2396 (BM); *loc. eodem*, Apr. 1935, *F. Guiol* s.n. (BM); *loc. eodem*, May 1936, *F. Guiol* s.n. (BM). **Euboea:** Mt Ochi, 27 Apr. 1933, *F. Guiol* 2329 (BM); Mt Ochi, above Karistos, N slopes, 880 m, 38°04'N, 24°27'E, *Pteridium aquilinum* with scattered *Castanea sativa*, *Platanus orientalis* and *Crataegus* sp., limestones, 28 May 2002, *D. Y. Hong*, *D. M. Zhang* & *X. Q. Wang* H02226 (A, BM, CAS, K, MO, P, PE); Mt Ochi, 27 Apr. 1933, Mt Ochi, above Rouklia, c. 850 m, 5 May 1974, *D. Tzanoudakis* 1220 (G, UPA); Agia Anna, Mt Xero, 750–950 m, 2 June 1955, *K. H. Rechinger* 17105 (G); Mt Dirfis, 1896 (flowering on 3 Apr. 1897 in Athen Bot. Gard., flowers white), *T. de Heideich* s.n. (WU); above Metochi, Dirphyos, c. 600 m, 3 May 1974, *D. Tzanoudakis* 1205 (GZU, UPA); Halkis, Mt Dirfis, 700–800 m, 19 Apr. 1975, *E. Stamatiadou* 18237 (BM, E); Halkis, Mt Dirfis, ENE of Steni Dirfios, 700–800 m, *Abies* forests, 19 Apr. 1975, *E. Stamatiadou* 19258 (ATH); Halkis, Mt Dirfis, N-NW of Xirovouni, 26 Apr. 1999, *Skaltsounis* 23478 (ATH). **Ikaria:** Mileopon, 400–600 m, 6 May 1976, *E. Stamatiadou* 19188 (ATH, BM, E); Mt Atheras, S of Ploumari Village, 550–650 m, 20 May 1970, *E. Stamatiadou* 9179 (ATH). **Lakonia:** Mt Taigetos, Neraidovuno, 29 Aug. 1898, *T. de Heideich* s.n. (WU); *loc. eodem*, 2,000 m, 8 May 1900, *T. de Heideich* s.n. (WU); *loc. eodem*, 20 June 1900, *T. de Heideich* s.n. (WU).

21d. *Paeonia mascula* subsp. *russoi* (Biv.) Cullen & Heywood, *Feddes Repert.* 69: 35 (1964), pro parte, excl. pl. Cors. & Sardin.; Cullen & Heywood in Tutin *et al.*, *Fl. Europ.* 1: 264 (1964); Stearn & Davis, *Peonies Greece*, 87–93 (1984), quoad nom.; Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 294 (1993), pro parte, excl. pl. C Spain and W Greece. *Paeonia russoi* Biv., *Stirp. rar. Sicilia* 4: 12 (1816); de Candolle, *Prodr.* 1: 66 (1824); Gussone, *Fl. sicil. syn.* 2: 26 (1843); Lynch, *J. Roy. Hort. Soc.* 12: 436 (1890), pro parte, excl. pl. Cors., Sardin. & Algeria.; Stern, *J. Roy. Hort. Soc.* 68: 126 (1943); Stern, *Study Gen. Paeonia*, 63 (1946), pro parte, excl. pl. Cors. & Sardin. *Paeonia mascula* (L.) Mill. var. *russoi* (Biv.) Gürke in Richter (ed.), *Pl. eur.* 2(3): 401 (1903), pro parte, quoad pl. Sicil. *Paeonia corallina* Retz. var. *russoi* (Biv.) Coss., *Comp. fl. atlant.* 2: 53 (1887), pro parte, quoad pl. Sicil.; *Paeonia officinalis* L. var. *russoi* (Biv.) Fiori in Fiori & Paoletti, *Icon. Fl. Ital.*, 188, fig. 1638 (1899), pro parte, excl. pl. Cors. & Sardin. *Paeonia mascula* (L.) Mill. subsp. *mascula* var. *russoi* (Biv.) Passalacqua & Bernardo, *Webbia* 59(2): 260 (2004). TYPE: Sicily, Palermo, Mt Pizzuta, 700 m, 28 May 1996, *L. Bernardo* & *N. G. Passalacqua* s.n. (neotype designated by Passalacqua & Bernardo, 2004: CLU, n.v.; isoneotype FI).

Paeonia flavescens C. Presl, *Delic. prag.* 1: 5 (1822), pro parte, excl. syn. *P. cretica*. *Paeonia corallina* Retz. var. *flavescens* (C. Presl) Guss., *Fl. sicil. syn.* 2(1): 26 (1843). *Paeonia mascula* (L.) Mill. var. *flavescens* (C. Presl) Gürke in Richter (ed.), *Pl. eur.* 2(3): 400 (1903). TYPE: Sicily, Madonie Mts, limestones, July 1873, *P. G. Strobl* s.n. (neotype here designated, K!; isoneotypes RO!, WU!).

Paeonia corallina Retz. f. *ovatifolia* (Boiss. & Reut.) Rouy & Foucaud, *Fl. France* 1: 144 (1893). TYPE: not designated.

P. corallina Retz. var. *broteri* auct. non Boiss. & Reut.: Ascherson & Graebner, *Syn. mitteleur. Fl.* 5(2): 550 (1923), pro parte, excl. pl. Cors.

P. mascula (L.) Mill. subsp. *hellenica* auct. non Tzanoud.: Stearn & Davis, *Peonies Greece*, 95 (1984), pro parte, quoad pl. Sicil.

PHENOLOGY. Flowering from April to middle Mây; fruiting in August.

CHROMOSOME NUMBER. $2n = 20$ (Barber, 1941; Bernardo *et al.*, 1995; Raimondo *et al.*, 1983; Stern, 1944; the present work with the voucher: Sicily, Mt Carbonara, D. Y. Hong *et al.* H01020 (A, BM, CAS, K, MO, PE, UPA)).

HABITAT AND DISTRIBUTION. Growing in sparse forests dominated by *Fagus sylvestris*, *Quercus* sp. and *Castanea sativa*, or in thickets of *Crataegus* sp.; on limestones at altitudes from 800 to 1,650 m. Confined to Sicily and Calabria, Italy (Map 5.21).

NOTES. *Paeonia mascula* subsp. *russoi* is characterised by petals that are mostly white, or white with pink shade at the base or periphery, less frequently pink or red, and leaves that are mostly rather densely hispid, rarely glabrous beneath.

The subspecies has also been reported to occur in Corsica (France), Sardinia (Italy), and the Ionian islands and Akarnania Province (Greece). However, the peonies in these regions have leaflets/leaf segments 9, rarely more in number, are nearly always villose beneath, have carpels covered with short hairs (1.5 mm long) and have chromosomes $2n = 10$. They actually form a separate species, *Paeonia corsica* Sieber ex Tausch (1828) (Hong & Wang, 2006). Thus, *P. mascula* subsp. *russoi* is confined to Sicily and Calabria.

ADDITIONAL SPECIMENS EXAMINED. ITALY, SICILY, s. loc., 1912, C. W. Müller 4 (K); E Sicily, Sarnomi, 27 Apr. 1908, Briquet s.n. (G). **Catania: 10 km NW of Randazzo, Cannata, 800–900 m, in deciduous forests, 3 June 1979, D. Davis & S. Sutton 64405 (BM); Etna, Borgia s.n. (RO). **Messina**, c. 16 km N of Randazzo, 1,000 m, *Castanea sativa* woodlands, 10 June 1979, D. Davis & S. Sutton 64262 (BM). **Palermo:** Madonie Mts, above Polizzi Generosa, 1,500 m, 17 June 1965, R. K. Brummitt, D. R. Hunt & O. A. Leistner 5199 (K); *loc. eodem*, Mt Carbonara, 1,630 m, 37°52'N, 14°02'E, edges of *Fagus sylvestris* forests, limestones, 5 June 2001, D. Y. Hong, X. Q. Wang & A. Fridlender H01020 (A, BM, CAS, K, MO, PE, UPA); Madonie Mts, June 1844, Lereocke s.n. (G); Madonie Mts, above Collesano, 1,100 m, *Quercus–Ilex* forests, limestones, 18 Aug. 1964, P. H. Davis 40140 (E, LD); 14 km SW of Collesano, Piano Zucchi, Refugio Orestano, dry calcareous stony slopes, under *Quercus* forests, 1,100 m, 15 July 1983, J. R. Akeroyd 3477 (BM); Madonie Mts, limestones, Apr. 1873, P. G. Strobl s.n. (K, RO, WU); 27 km S of Cefalu, S of Isnello, c. 1,400 m, D. Davis & S. Sutton 63835 (BM); c. 35 km S of Cefalu, S of Isnello, c. 1,000 m, 26 May 1979, D. Davis & S. Sutton 63828 (BM). Palazzo Adriano, Mt Rose, 37°39'N, 13°24'E, 1,100 m, 1 June 2000, A. Herrero *et al.* AH783 (MA). Ficuzza: Mt Busambra, 800–1,000 m, 28 May 1972, C. A. Stace & R. Cotton 390 (BM); Mt Rocca Busambra, 1,050–1,200 m, limestones, 30 May 1982, G. & W. Sauer 27671 (SA). Portelle, 1,400 m, 9 June 1983, A. Charpin & M. Di-Hrich AC-18089 (G). S Martino: near Panormum, 28 May 1856, E. & A. Huet du Pavillon 449 (G); S Martino, June 1890, D. Lanza s.n. (RO); *loc. eodem*, May 1932, A. Cacciato s.n. (RO); Mt Cuccio, near Panormum, 2 Apr. 1855, E. A. Huet du Pavillon s.n. (BM, G, K); Mt Panormi, 1825, Gunoni s.n. (G). Near Palermo: mountain pastures, 4 June 1899, C. C. Lacaita s.n. (BM); near Palermo, in forests, Apr. 1896, H. Ross s.n. (B, P, WU); *loc. eodem*, June 1896, H. Ross s.n. (B, P, WU); *loc. eodem*, G. Pasleniza s.n. (RO); *loc. eodem*, Apr. 1899, H. Ross s.n. (BM); *loc. eodem*, June 1899, H. Ross s.n. (BM). Polizzi, Mt Scaloni, limestones, 23 June 1873, P. G. Strobl s.n. (WU). Mt Pizzuta: in forests, 7 June 1890, D. Lanza s.n. (RO); *loc. eodem*, Apr. 1890, D. Lanza s.n. (RO); *loc. eodem*, June 1890, D. Lanza s.n. (RO); Mt Pizzuta, summit, 1,240 m, among exposed calcareous rocks with scattered *Crataegus* and small oaks, 4 June 2001, D. Y. Hong & X. Q. Wang H01019 (PE); Mt Pizzuta, 1,180 m, 7 June 1907, C. C. Lacaita 07–184 (BM); Mt Pizzuta, 23 May 1855, E. & A. Huet du Pavillon s.n. (BM, G, P).**



Fig. 5.22A. *Paeonia mairei* H. Lév.: **a**, the lower part of the plant, showing carrot-shaped roots, caudex and scales at the base of the stem; **b**, the upper part of the plant and a flower with petals and stamens shed, showing disk and carpels; **c**, a lower leaf; **d**, a carpel. Drawn by Miss LI Ai-Li.

22. *Paeonia mairei* H. Lév., *Bull. Acad. Int. Géogr. Bot.* 25: 42 (1915); Handel-Mazzetti, *Acta Horti Gothob.* 13: 38 (1939); Stern, *J. Roy. Hort. Soc.* 68: 128 (1943); Stern, *Study Gen. Paeonia*, 79 (1946); Pan, *Fl. Reip. Pop. Sin.* 27: 50 (1979); Hong, Pan & Turland in Wu, Raven & Hong, *Fl. China* 6: 131 (2001). TYPE: China, Yunnan, "Pâtures-brousse du Io-Chan (Yo-Shan), 3,200 m", May 1911, E. E. Maire s.n. (lectotype designated by Handel-Mazzetti, 1939: 38, E!). *Paeonia bifurcata* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR*, 1(7): 3 (1920); Stern, *Study Gen. Paeonia*, 79 (1946), pro syn. sub *P. mairei*. TYPE: China, Su-tchuen (Sichuan, now Chongqing), Tchen-keou-tin (Chengkou County), R. P. Farges 566 (holotype LE!; isotypes K!, P!). *Paeonia oxypetala* Hand.-Mazz., *Acad. Wissenschaften Wien* 57: 265 (1920) & *Symb. sin.* 7: 265 (1931); Stern, *J. Roy. Hort. Soc.* 68: 128 (1943); Stern, *Study Gen. Paeonia*, 80 (1946); Pan, *Fl. Reip. Pop. Sin.* 27: 50 (1979), pro syn. sub *P. mairei*. *Paeonia mairei* H. Lév. f. *oxypetala* (Hand.-Mazz.) W. P. Fang, *Acta Phytotax. Sin.* 7(4): 307, 319 (1958). TYPE: China: Setschwan (Sichuan) austro-occid., Daliang-Schan ad orient. urbis Ningyüen, c. 2,700 m, 25 Apr. 1914, Handel-Mazzetti 1735 (holotype WU!).

Perennials up to 1 m tall. Roots thick, carrot-shaped. Caudex (rhizomes) c. 2 cm in diameter, up to 15 cm long. Stems single, simple, glabrous. Lower leaves biternate, with some leaflets segmented; leaflets/leaf segments 13–24, but mostly 14–17 in number, oblong-ovate or oblong-lanceolate, 6–16.5 cm long, 1.8–7 cm wide, glabrous, cuneate at the base, usually acuminate or even caudate at the apex. Flowers solitary, terminal; involucre bracts 1–3 in number, leaf-like or linear; sepals 3–5 in number, green, broadly ovate, all rounded or sometimes one caudate at the apex, 1–1.5 cm long, 0.9–1.2 cm wide; petals 7–9 in number, pink to red, obovate, 3.5–7 cm long, 2–4.5 cm wide, usually rounded at the apex; filaments purple-red; anthers yellow; disk yellow, annular, c. 1 mm high; carpels 2–3, rarely 1 in number, sparsely to densely yellow papillate to hispidulous, sometimes glabrous; styles up to 4 mm long; stigmas red, 1.2–1.5 mm wide. Follicles 3–3.5 cm long, 1–1.2 cm in diameter. Seeds black, oblong-spherical, 7–8 mm long, 4–5 mm in diameter. Figs 5.22A, 5.22B.

PHENOLOGY. Flowering in April and May; fruiting from August to September.

CHROMOSOME NUMBER. $2n = 20$ (Hong *et al.*, 1988; Dr Q. E. Yang, personal communication, locality: Qiaojia County of Yunnan, the type locality). Leeper's (1968) reports of $2n = 10$ for this species seem doubtful. They failed in neither providing the vouchers nor indicating the origin of the materials they used. Our observations on the chromosomes of this species (Hong *et al.*, 1988) and Yang's work cover four localities in three provinces: Shaanxi in the N of the distribution range, Yunnan in the S, and Sichuan. All show $2n = 20$.

HABITAT AND DISTRIBUTION.

Growing in deciduous broad-leaved forests at an altitude of 1,200–3,400 m, on limestones. In Chongqing, SE Gansu, W Hubei, S Shaanxi, C & S Sichuan, and NE Yunnan; endemic to China (Map 5.22).

DIAGNOSTIC CHARACTERS. *Paeonia mairei* is a very distinct species with no close relatives evident. It is characterised by caudate-acuminate or acuminate leaflets/leaf segments, conspicuous styles, single stems, and plants that are

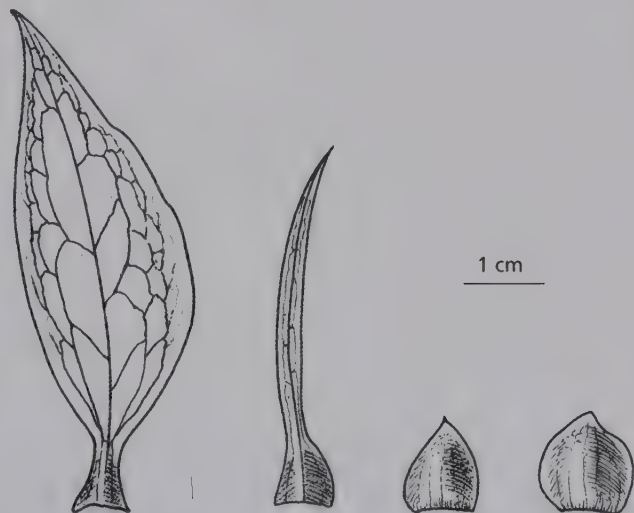
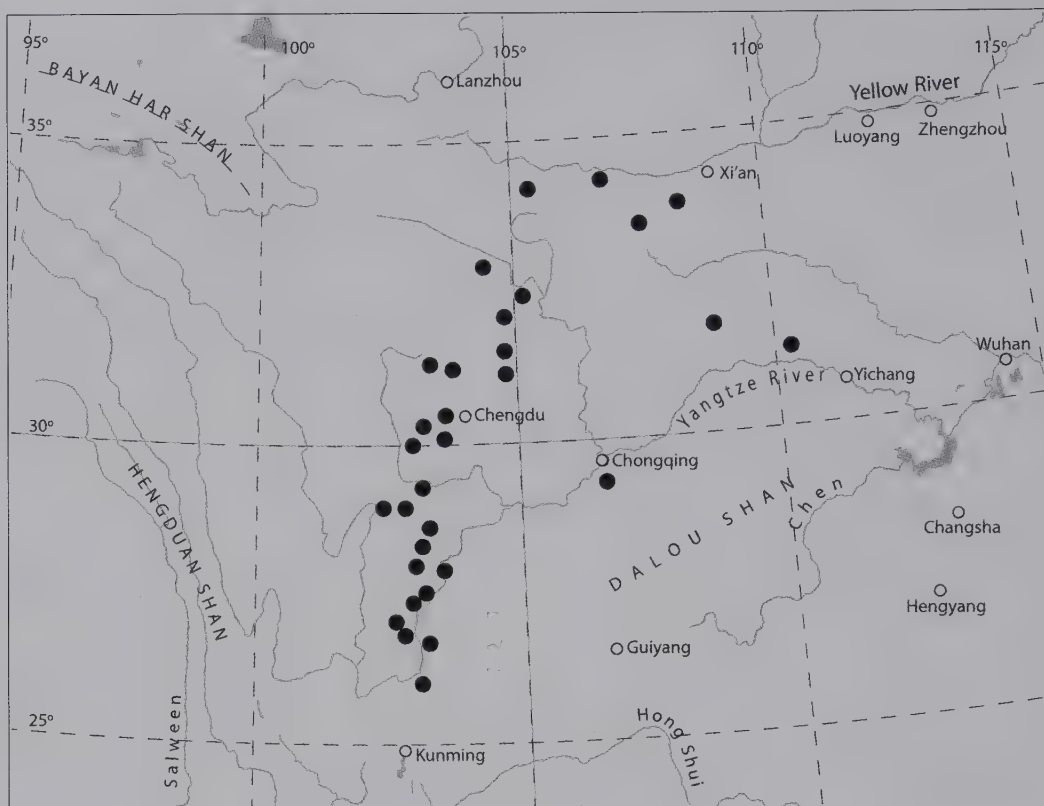


Fig. 5.22B. *Paeonia mairei* H. Lév.: involucre bracts and sepals, based on D. Y. Hong & H. Yu H04036 (PE). Drawn by Mr SUN Yin-Bao.



Map 5.22. Distribution of *Paeonia mairai* H. Lév.

always entirely glabrous except for the carpels. The presence of indumentum on the carpels is unique in the whole genus.

ADDITIONAL SPECIMENS EXAMINED. CHINA, CHONGQING, Nanchuan: Mt Jinfoshan, Liangjiawan, 1,250 m, 10 Apr. 1986, X. Y. Zhu & S. Y. Song PB86036 (PE); Mt Jinfoshan, on way to Shimaoliang, 1,620 m, 9 May 1986, X. Y. Zhu & S. Y. Song PB86028 (PE). **GANSU, Tianshui:** Baiyanglin, Zhifanggou, 1,870 m, 26 July 1951, Z. W. Zhang 128 (PE); *loc. eodem*, 1,800 m, in forests, 26 July 1951, J. M. Liu 10226 (PE); Baiyanglin, Dashuiyu, 1,900 m, 26 July 1951, Z. W. Zhang 129 (PE). **HUBEI, Shennongjia:** Songbai, Shantunyan, May 1988, J. Z. Qiu PB88601 (PE); **SHAANXI, Huxian:** Gaoguanyu, Xinjialin, 1,900 m, in forest, 4 May 1959, *Pharmaceutic Exped.* 2015 (PE); *loc. eodem*, 1,800 m, 8 May 1959, *Pharmaceutic Exped.* 2028 (PE). **Ningshan:** N of Huoditang, N slope, c. 2,000 m, limestones, in coniferous and deciduous broad-leaved mixed forests, 7 May 1997, D. Y. Hong, Y. Z. Ye & Y. X. Feng H97053 (A, CAS, K, MO, PE, US); Dianyangba, 1,400 m, in forests, fl. pink, 24 Apr. 1993, X. H. Tian & L. Zhang T934001 (PE). **Mt Taibai:** 1938, W. Y. Hsia 36 (PE); *loc. eodem*, Dadian Temple to Dumugong Temple, 2,400–2,600 m, 24 May 1985, D. Y. Hong & X. Y. Zhu PB85064 (PE); *loc. eodem*, 22 June 2004, D. Y. Hong & Y. Ren H04036 (PE). **Yangxian:** Huayang, Daping, 33°41'N, 107°32'E, in forests, 4 June 1999, Zhu, Chen, Xu & Wang 1127 (PE). **SICHUAN, Anxian,** Mt Chaping, 1,800 m, 16 July 1978, *Anxian Exped.* 225 (SM). **Baoxing:** Dachigou, in dense forests, 2,200 m, 12 Aug. 1961, J. S. Ying 10116 (PE); Longdong Township, Luotuoshan, Dabeiniu, 1,550 m, in shady valleys, 20 Apr. 1959, *Sichuan Econ. Plants Exped.* 071 (PE); Longdong Township, 2,000 m, in forests, 19 May 1958, X. S. Zhang & Y. X. Ren 4829 (PE); Lengbaogou, Shangding, 2,750 m, in bushes, 14 June 1933, T. T. Yü 2006 (PE); Zhonggan Village, Longzaigou, 2,300 m, in forests, 6 June 1958, X. S. Zhang & Y. X. Ren

5197 (PE); Qiaopi, 2,500 m, in thickets, 20 May 1982, D. Y. Hong & Z. H. Zhong PB82122 (PE). **Beichuan**, Jianshe, 1,200 m, 25 July 1978, *Beichuan Exped.* 190 (SM). **Butuo**, Jiochenhe Distr., Lianhui Township, 3,000 m, 30 May 1973, *Sichuan Inst. Chinese Materia Medica Exped.* 221 (SM). **Ganluo**: Xinrun, 2,400 m, in bushes, 10 Aug. 1959, *Sichuan Econ. Plants Exped.* 4457 (PE); Sizu, Polibaja, in forests, 1959, *Sichuan Econ. Plants Exped.* 4431 (PE); Liangsha Township, *Sichuan Inst. Chinese Materia Medica Exped.* 237 (SM). **Hongxi**, Wahei, 2,200 m, in forests, 19 July 1959, *Sichuan Econ. Plants Exped.* 1383 (PE). **Jinyang**, Duiping Distr., Genbao, 1,800 m, grassy slopes, 1 June 1959, *Sichuan Econ. Plants Exped.* 3363 (PE). **Leibo**, 2,400 m, in forests, 18 June 1959, *Sichuan Econ. Plants Exped.* 0735 (PE). **Lixian**, Longxi Township, Badogou, in forests, 11 May 1952, Z. He 12388 (PE). **Maoxian**: 1,700 m, in forests, 14 May 1989, J. Z. Qiu PB89101 (PE) and J. Z. Qiu PB89102 (PE); Tudiliangzi (Ecological Station), 2,200 m, 21 May 1996, K. Y. Pan & Y. H. He 96004 (PE). **Mianning**: Tuowu, Zhilechahe, 20 July 1959, S. G. Wu 1960 (PE); Yele Township, 3,000 m, 6 July 1978, *Sichuan Inst. Chinese Materia Medica Exped.* 296 (SM). **Meigu**: Houbulietuo, shady slopes, thickets, 21 Aug. 1959, *Sichuan Econ. Plants Exped.* 1914 (PE); Bapu Distr., Huangjiaolou Township, 2,500 m, 28 Apr. 1979, *Sichuan Inst. Chinese Materia Medica Exped.* 56 (SM). **Nanping**, Shuanghe, Tuanjie Village, 2,200 m, in forests, 5 June 1979, s. coll. 0333 (SM). **Ningnan**, Lianhui, Mt Laojun, 3,400 m, 30 May 1978, *Sichuan Inst. Chinese Materia Medica Exped.* 92 (SM). **Pingwu**: Hule Township, 18 July 1978, *Sichuan Inst. Chinese Materia Medica Exped.* 580 (SM); Shuijin, Huangyang Village, 1,800 m, 21 May 1961, s. coll. 13034 (SM). **Puge**, 12 Sep. 1979, *Sichuan Inst. Chinese Materia Medica Exped.* 848 (SM). **Qingchuan**: Qingxi Township, Muwanchang, in forests, 1,680 m, 31 May 1965, *Sichuan Inst. Chinese Materia Medica Exped.* 2191 (SM); Qinxi Distr., Yuba, by forests, 1,200 m, 21 May 1965, *Sichuan Inst. Chinese Materia Medica Exped.* 2130 (SM); Qinxi Distr., Sanguo Township, 1,500 m, 17 July 1965, *Sichuan Inst. Chinese Materia Medica Exped.* 2507 (SM). **Qionglai**, Shuikou, 1,200 m, 11 Apr. 1979, *Sichuan Inst. Chinese Materia Medica Exped.* 245 (SM). **Shimian**, 14 Apr. 1955, C. J. Xie (C. C. Hsieh) 39934 (PE). **Tianquan**: Mt Erlong, X. C. Jiang (H. L. Tsiang) 33937 (PE); s. loc., 1936, K. L. Chü 2400 (PE); s. loc., 1936, K. L. Chü 2407 (PE). **Wenchuan**, the Wolong Nature Reserve, Tangfang, 1,860 m, in secondary *Larix-Juglans* forests, 9 May 1985, D. Y. Hong & X. Y. Zhu PB85023 (PE). **Yuexi**: Gongshan Dashuigou, 2,000 m, 11 Apr. 1979, *Sichuan Inst. Chinese Materia Medica Exped.* 99 (SM); Dongshan, Dashuigou, in thickets, 2,200 m, 18 Apr. 1986, X. Y. Zhu & S. Y. Song PB86024B (PE); loc. eodem, 2,200 m, 18 Apr. 1986, X. Y. Zhu & S. Y. Song PB86034 (PE); loc. eodem, 2,250 m, in thickets, 18 Apr. 1986, X. Y. Zhu & S. Y. Song PB86026 (PE); loc. eodem, 1,960 m, 21 Apr. 1986, X. Y. Zhu & S. Y. Song PB86029 (PE); loc. eodem, 1,920 m, 21 Apr. 1986, X. Y. Zhu & S. Y. Song PB86030 (PE); loc. eodem, 1,910 m, 21 Apr. 1986, X. Y. Zhu & S. Y. Song PB86031 (PE). **Zhaojue**: Zhuhe Distr., Shedi Township, 2,500 m, 2 Aug. 1979, *Sichuan Inst. Chinese Materia Medica Exped.* 853 (SM); Zhu'er Distr., Boluo Township, 2,440 m, 29 June 1979, *Sichuan Inst. Chinese Materia Medica Exped.* 639 (SM); Jiefanggou, in thickets, 11 Apr. 1984, D. Z. Fu 84220 (PE). **YUNNAN**, **Dongchuan**: Tangdan, Xinqiao Village, 2,650 m, 24 May 2004, D. Y. Hong & H. Yu H04031 (PE); loc. eodem, 3 May 1964, D. C. Liu s.n. (KUN); Yingmin, Wagangzhai, 3,000 m, in thickets, 29 Apr. 1985, S. B. Lan 378 (PE). **Mo-Tsou**, 800 m, May 1912, E. E. Maire s.n. (E).

23. *Paeonia kesrouanensis* (Thiébaud) Thiébaud, *Fl. Lib.-Syr.* (in *Mém. Inst. Égypte*, Cairo, 31): 37 (1936); Stern, *J. Roy. Hort. Soc.* 68: 125 (1943); Stern, *Study Gen. Paeonia*, 73 (1946); Davis & Cullen in Davis, *Fl. Turkey* 1: 206 (1965); Mousterde, *Nouv. Fl. Liban Syrie* 2: 4, pl. 3–2 (1970); Hong, Wang, Zhang & Koruklu, *Nordic J. Bot.* 23: 398 (2005). *Paeonia corallina* Retz. var. *kesrouanensis* Thiébaud, *Bull. Soc. Bot. France* 81: 114 (1934). *Paeonia mascula* (L.) Mill. subsp. *kesrouanensis* (Thiébaud) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 29 (1997) and *Gen. Paeonia*, 86 (2004). TYPE: Lebanon, Feitroun (Kesrouan), 25 km NE of Beirut (Beyrouth), 1,200 m, 10 Apr. 1932, J. Thiébaud s.n. (lectotype designated by Davis & Cullen 1965b: 206, P!; isolectotype K!).



Fig. 5.23A. *Paeonia kesrouanensis* (Thiébaud) Thiébaud: a, the lower part of stem; b, a lower leaf; c, a flower with petals and stamens shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.

Paeonia turcica P. H. Davis & Cullen, *Notes Roy. Bot. Gard. Edinburgh* 26: 176 (1965) and in Davis, *Fl. Turkey* 1: 206 (1965); Özhatay, Page & Sinnott, *Bot. Mag.* 17(1): 97 (2000). TYPE: Turkey, "Denizli, Boz Dağ, above Abbas (Olukbasi), 1,500–1,800 m, in steep *Pinus nigra* forests above Geyran Yayla, 16 July 1947, Davis 13327" (cited from the holotype sheet) (holotype K!; isotype E!) (not 16 July 1941, Davis 13359, as written by Davis and Cullen (1965a)).

Perennials. Roots carrot-shaped. Stems 35–80 cm tall, glabrous, green, sometimes with purple spots or partially purple at the base, with 4–7 yellow-green scales at the base. Petioles and petiolules glabrous. Lower leaves biternate; leaflets/leaf segments 10–14, rarely up to 17 in number, ovate or elliptic, acute at the apex, 8–18 cm long, 4–7.5 cm wide, glabrous above, sparsely to rather densely villose beneath. Flowers solitary; involucre bracts mostly one, rarely 2 in number, leaf-like, or absent; sepals 3–4, less frequently 2 or 5 in number, nearly orbicular, mostly or all rounded but sometimes one acute at the apex, green but often purple at the periphery, usually glabrous, rarely sparsely hirsute outside; petals 5–9 in number, pale pink, pink or red, 4.5–6.3 cm long, 2.5–4.2 cm wide, mostly entire, rarely incised; filaments dark purple; anthers yellow; disk 1 mm high, entire, rarely waved; carpels 1–3, rarely 4 or 5 in number, glabrous; styles 1.5–3.5 mm long, styles and straight part of stigmas together 3.5–7.0 mm long. Figs 5.23A, 5.23B, 5.23C.

PHENOLOGY. Flowering from late April to late May; fruiting from late July to September.

CHROMOSOME NUMBER. $2n = 20$ (Özhatay *et al.*, 2000; the present work with the voucher: Turkey, Antalya; D. Y. Hong *et al.* H02208 (A, CAS, K, MO, PE, UPA)).

HABITAT AND DISTRIBUTION. Growing in *Fagus orientalis*, *Pinus nigra* or *Cedrus libani* forests or in *Quercus* scrubs in areas of limestones or metamorphic rocks at altitudes from 1,000 to 1,800 m. Confined to Lebanon, SW Syria, and SW and S Turkey (Map 5.23).

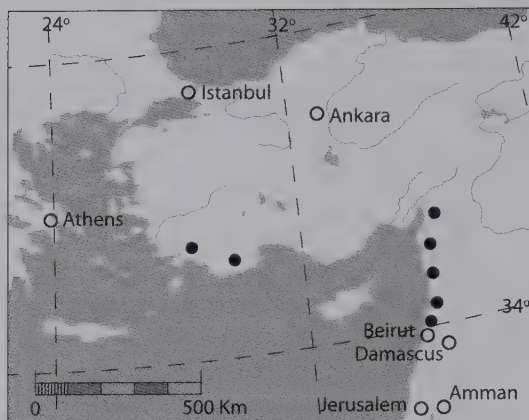
NOTES. *Paeonia kesrouanensis* is a distinct species. It grows together with *P. daurica* in Mt Amanos in S Turkey, but we found no hybrids there. It differs from *P. daurica* not only in morphology (lower leaves with 10–17 leaflets/leaf segments; carpels 1–3, always glabrous in *P. kesrouanensis*) but also in ploidy ($2n = 20$ for *P. kesrouanensis* versus $2n = 10$ for *P. daurica*). *Paeonia kesrouanensis* also grows together with *P. mascula* on Ziyaret Hill, above Senkoy, Antakya, Turkey, where we did not find hybrids. The population of *P. mascula* there, like the populations elsewhere, had carpels that were 3–5 in number and lanate, and sessile stigmas, and was thus distinct from *P. kesrouanensis*. *Paeonia kesrouanensis* is similar to two other allopatric species, *P. coriacea* (S Spain and Morocco) and *P. cambessedesii* (the Balears, Spain). However, *P. coriacea* is nearly always glabrous throughout, and *P. cambessedesii* is always glabrous throughout, with its lower leaves nearly always of 9 entire leaflets and mostly (3–)4–6(–8) carpels.



Fig. 5.23B. *Paeonia kesrouanensis* (Thiébaud) Thiébaud: carrot-shaped roots. Drawn by Miss LI Ai-Li.

Paeonia turcica was described as new by Davis and Cullen (1965a) due to its having styles and stigma that are shorter than those in *P. kesrouanensis* and curved near the base (rather than curved only at the apex in *P. kesrouanensis*). The length of style and stigma in *P. turcica* is, however, in the variation range of those in *P. kesrouanensis* (4.5–7 mm) and they curve at various positions (Fig. 3.15). Therefore, *P. turcica* was treated as a synonym of *P. kesrouanensis* (Hong *et al.*, 2005).

Davis and Cullen (1965a) designated the holotype of their new species as “Prov. Denizli: Boz. Dag above Abbas, 1,500–1,800 m, in steep *Pinus nigra* forest above Geyran Yayla, local, flowers said to be red, 16 vii 1941, Davis 13359 (holotype K, isotype E)”. I found two sheets in K with handwriting “*Paeonia turcica* P. H. Davis”, one of which is with Davis’ field record in handwriting exactly the same as the note above but “16 vii 1947”, and “Davis 13327” in ink “or 13359” in pencil. The other sheet has “Vil Denizli” and “13359” in ink “or 13327” in pencil. Therefore, we are quite sure that they made a mistake and that the type should be “16 vii 1947, Davis 13327” (holotype K., isotype E). In Edinburgh, there are also two sheets of this collection. One is labelled “16 July 1941” and “No. 13359” in ink under which is written “13327” in pencil. The other is labelled “16 July 1947” and “No. 13359” in ink under which is written “13327” in pencil. Apparently Davis and Cullen (1965a) designated type specimens according to the sheet 1 in E. As they designated the sheet at Kew as holotype, the holotype should be “16 July 1947”, “P. H. Davis 13327”. The numbers of P. H. Davis’ collections increased with time; hence 13327 and 13359 should have been collected in 1947 rather than in 1941.



Map 5.23. Distribution of *Paeonia kesrouanensis* (Thiébaud) Thiébaud.

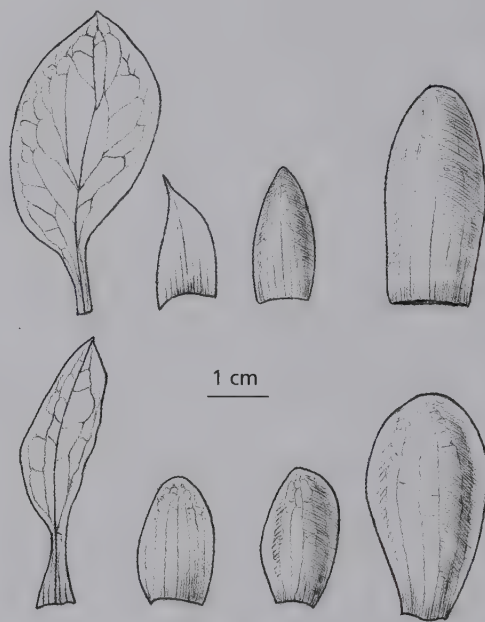


Fig. 5.23C. *Paeonia kesrouanensis* (Thiébaud) Thiébaud: involucre bracts and sepals of two flowers based on D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02210 (A, BM, CAS, K, MO, PE). Drawn by Mr SUN Yin-Bao.

ADDITIONAL SPECIMENS EXAMINED. LEBANON, Aramoun: 10 May 1934, *P. Mouterde* 3056 (G); Aramoun, 2 Apr. 1940, *P. Mouterde* 6655 (G); between Aramoun and Chahtoul, 5 June 1956, *P. Mouterde* 11691 (G); Northern part, Amouah, Mt Akar, 1,500 m, *Abies cilicica* forests, 15 June 1943, *P. H. Davis* 6299 (E, K); Foret de Qamoua, 13 May 1964, *s. coll.* s.n. (G). **SYRIA:** Slenfi, *Cedrus* forests, 24 Apr. 1953, *H. Pabot* s.n. (G); Slenfi, 6 May 1954, *H. Pabot* s.n. (G); *s. loc.*, *P. Tillet* s.n. (G). **TURKEY, Antalya:** S of Elmali, Kuhu Dağ, 1,750 m, 12 June 1969, *K. Fitz & F. Spitzenberger* 787 (W); S of Elmali, 10 km from Akcay to Cas road, near Sevindik, above Patlangac, 36°32'N, 29°45'E,

1,570 m, limestones, NW slopes, *Cedrus libani* forests, 15 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02208 (A, BM, CAS, K, MO, PE). **Denizli:** Acipayam, Mt Boz Dağ, above Olukbasi (Abbas), 37°15'N, 29°10'E (the type locality of *Paeonia turcica*), 1,450 m, limestones, E slopes, *Pinus nigra* forests; by streams, 15 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02207 (A, BM, CAS, K, MO, PE, UPA). **Hatay:** Antakya to Yayladag, 1,000 m, 28 Apr. 1957, P. H. Davis & Hedge 27158 (BM, K); Antakya, Senkoy, 12 May 1976, H. J. Leep 76–T44 (SA); *loc. eodem*, above Senkoy, Ziyaret Hill, 36°02'N, 36°06'E, 1,180 m, limestones, S slopes, *Quercus* scrubs, 17 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02210 (A, BM, CAS, K, MO, PE, UPA); Mt Amanos, above Topaktas, 1,300 m, *Fagus orientalis* forests, 15 Apr. 1968, Y. Akman 8000 (ANK); Mt Amanos, above Topaktas, 36°49'N, 36°20'E, 1,380–1,540 m, metamorphic rocks, SW slopes, *Fagus orientalis* forests, 18 May 2002, D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu H02214 (A, CAS, K, MO, PE, UPA).

- 24. *Paeonia coriacea*** Boiss., *Elench. pl. nov.* 7 (1838) and *Voy. bot. Espagne* 1: 14, tab. 3 (1839); Willkomm & Lange, *Prodr. fl. hispan.* 3: 976 (1880), pro parte, excl. pl. Alger.; Lynch, *J. Roy. Hort. Soc.* 12: 435 (1890), pro parte, excl. pl. Alger.; Huth, *Bot. Jahrb. Syst.* 14(3): 266 (1891), pro parte, excl. pl. Alger.; Gürke in Richter (ed.), *Pl. eur.* 2: 400 (1903), pro parte, excl. pl. Alger.; Stern, *Study Gen. Paeonia*, 88 (1946), pro parte, excl. var. *atlantica*; Cullen & Heywood in Tutin *et al.*, *Fl. Europ.* 1: 244 (1964); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 294 (1993), pro parte, excl. pl. Cors. & Sardin.; Muñoz-Garmendia & Navarro in Castroviejo *et al.*, *Fl. Iberica* 3: 148 (1993). *Paeonia mascula* (L.) Mill. subsp. *coriacea* (Boiss.) Malag., *Syn. Fl. Iberica* 369 (1975), pro parte, excl. pl. Cors. and Sardin.; Schmitt, *Pl. Mont.* 12(181): 179 (1997), pro parte, excl. pl. Cors. & Sardin. *Paeonia corallina* Retz. subsp. *coriacea* (Boiss.) Maire in Jahandiez & Maire, *Cat. pl. Maroc* 2: 240 (1932). *Paeonia corallina* Retz. var. *coriacea* (Boiss.) Coss., *Comp. fl. atlant.* 2: 53 (1887). *Paeonia russoi* Biv. var. *coriacea* (Boiss.) Coss. ex Batt. in Battandier & Trabut, *Fl. Algérie* 1: 18 (1888), pro parte, excl. pl. Alger. TYPE: Spain, Sierra Nevada, Supra San Geronimo, Boissier s.n. (lectotype designated by Burdet *et al.*, 1988: G!; isolectotype G!); Spain, Sierra Nevada, circa San Geronimo, June 1837, *El. n.* 6 ex herbier Boissier (syntype G!).
Paeonia corallina Retz. subsp. *coriacea* (Boiss.) Maire var. *maroccana* Pau & Font Quer ex Maire in Jahandiez & Maire, *Cat. pl. Maroc* 2: 240 (1932). *Paeonia coriacea* Boiss. var. *maroccana* (Pau & Font Quer ex Maire) Romo, *J. Linn. Soc. Bot.* 108 (3): 207 (1992). TYPE: Morocco, Yebel (Mt) Tisouka, 1800 m, 13 June 1928, Font Quer 105 (lectotype here designated, BM!; isolectotypes BC!, G!).
Paeonia corallina Retz. var. *russoi* auct. non Biv.: Webb, *Iter hispan.* 80 (1838).
Paeonia russoi auct. non Biv.: Amo y Mora, *Fl. fan. Penins. Iberica* 5: 746 (1873).

Perennials glabrous throughout, very occasionally hairy on leaves and carpels. Roots carrot-shaped. Stems 40–90 cm tall, up to 1 cm in diameter, green but sometimes purple. Lower leaves biternate; leaflets 9, with 1 or several segmented; leaflets/leaf segments 10–15 in number, ovate-orbicular or broad-ovate, broad-cuneate at the base, acute, less frequently obtuse or short-acuminate at the apex, 5–15 cm long, 2–8 cm wide, glabrous on both surfaces, very occasionally puberulous on the lower surface. Flowers solitary and terminal; involucrate bracts 1 or 2 in number, leaf-like, rarely absent; sepals usually 3, less frequently 2 in number, all or mostly rounded at the apex, 1.5–3.5 cm long, 1–2.5 cm wide, purple; petals red, acute or rounded, entire or slightly incised at the apex; disk waved, 1–2 mm high, red; carpels 1–4, but mostly 2 or 1 in number, glabrous, very rarely very sparsely hirsute; styles 1.5–3 mm long; stigmas red, 2–2.5 mm wide. Follicles 3.5–4.8 cm long. Seeds oblong, black, 7–8 mm long, 5–6 mm in diameter. Figs 5.24A, 5.24B.

PHENOLOGY. Flowering from late April to early June; fruiting in September.

CHROMOSOME NUMBER. $2n = 20$ (Barber, 1941; Langlet, 1927; Stebbins, 1938a; Stern, 1944; the present work with the voucher: Spain, Granada, D. Y. Hong & A. Quintanar H03018).

HABITAT AND DISTRIBUTION. Growing in woods of *Quercus* or *Cedrus* in limestone areas at an altitude

of 600–2,100 m. Confined to S Spain and Morocco (Map 5.24).

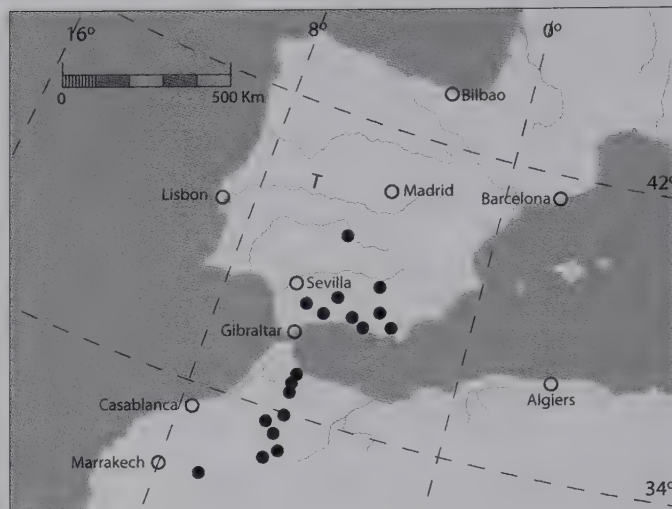
NOTES. *Paeonia coriacea* has been treated as a subspecies of *P. mascula* by some authors (Malagarriga, 1975; Schmitt, 1997). In *P. mascula*, carpels are mostly 3 or 4 in number, always lanate, with hairs as long as 3 mm, sessile stigmas, and leaves that are often hispid beneath, and thus *P. coriacea* is distinct from *P. mascula* in morphology. *Paeonia coriacea* has been confused with *P. corsica* Sieber ex Tausch in Corsica and Sardinia (Cullen & Heywood, 1964a, 1964b; Akeroyd, 1993; Schmitt, 1997). In some populations of *P. corsica* in Corsica (Mt Cagna) and Sardinia (Mt Limbardo), carpels were either glabrous or sparsely to densely hairy, and leaves also varied from glabrous to densely hairy; glabrous carpels were mostly not correlated with glabrous leaves. Furthermore, the peony in Corsica and Sardinia possessed 1–8 (mostly 2–5) carpels and styles of 1.5–3 mm in length, and was diploid. Thus, *P. coriacea* and *P. corsica* are two distinct species, and all peonies in Corsica and Sardinia belong to *P. corsica* (Hong & Wang, 2006).

We have examined more than 70 collections and all are glabrous throughout except for two, one from Mt Alfacar of Granada Province, Aedo, Muñoz-Garmendia & Navarro CN-520 (MA), and the other from Puebla de D. Rodrigo of Ciudad Real Province, J. L. Rodríguez Marzal s.n. (MA). The first collection has two sheets: one rather densely hirsute on the lower side of leaves and sparsely hirsute at the base and along dorsal suture of carpels; the other densely hirsute on the lower surface of leaves, hirsute at the base of carpels, and very sparsely hirsute on the other parts of carpels. The second collection is rather densely hirsute only on the lower surface of leaves. We suppose that the hairy individuals are just variants within populations. Eight collections were examined from Mt Alfacar, and we sampled a population from this mountain, where CN-520 is the only one with hairs.

The peony in Algeria has long been treated as a member of *Paeonia coriacea* or *P. mascula*. However, this is a distinct species, *P. algeriensis* Chabert, with larger and hairy leaflets/leaf segments, mostly single (less frequently two) carpels, and larger follicles (>4.5 cm long).

The peony in Algeria has long been treated as a member of *Paeonia coriacea* or *P. mascula*. However, this is a distinct species, *P. algeriensis* Chabert, with larger and hairy leaflets/leaf segments, mostly single (less frequently two) carpels, and larger follicles (>4.5 cm long).

ADDITIONAL SPECIMENS EXAMINED. MOROCCO, DEMNATE PROV.: *s. loc.*, 25 July 1879, Ibrahim s.n. (P); Mt Cahallali, 10 July 1881, Ibrahim s.n. (P); Mt Tahallati, 5 Apr. 1882, Ibrahim s.n. (BM, G, K, WU); *s. loc.*, 25 July 1879, Ibrahim s.n. (P); Mt Tahallati, 2 June 1881, Ibrahim s.n. (G, K). **MEKNES PROV.:** Azrou, 1,800 m, May 1938, G. l'Hermite s.n. (P); Azrou, Ain Leuh, 1,700 m, 19 June 1982, J. Fdez Casas, F. Muñoz-Garmendia, A. Susanna & M. T. Telleria FC7131 (G, MA); Azrou, Talambot, 33°26'N, 5°11'W, 1,700 m, 24 June 1982, J. Fdez Casas, F. Muñoz-Garmendia, A. Susanna & M. T. Telleria FC7255 (G); Azrou, Timahdite, 1,700 m, 11 June 1980, A. Chapin, J. Fdez Casas, F. Jacquemoud & D. Jeanmonod Mar 837 (G, MA); Azrou, Middle Atlas, 1,600–1,800 m, *Quercus*–*Cedrus* forests, 13 May 1928, Andreanszky s.n. (BP); above Azrou, 1,800 m, 8 May 1927, R. Maire s.n. (G); *loc. eodem*, 1,600 m, 19 Apr. 1926, R. Maire s.n. (P); *loc. eodem*, 1,500 m, limestones, 21 Apr. 1933, R. Maires s.n. (P); Azrou, Middle Atlas, above 1,520 m, in forests, H. Lynes 152 (BM); *loc. eodem*, 1,600 m, 6 June 1971, G. Bocquet 10472 (BM); Middle Atlas, Itzer, 1,900 m, 20 June 1981, J. Lewalle 9883 (BM); Middle Atlas, Ifrane, 1,680 m, 6 Apr. 1936, C. S. Garnett G 2618 (BM); *loc. eodem*, 1,220 m, 18 July 1976, C. J. & A. R.



Map 5.24. Distribution of *Paeonia coriacea* Boiss.



Fig. 5.24A. *Paeonia coriacea* Boiss.: **a**, a lower leaf; **b**, the upper part of stem; **c**, a flower with petals and stamens shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.

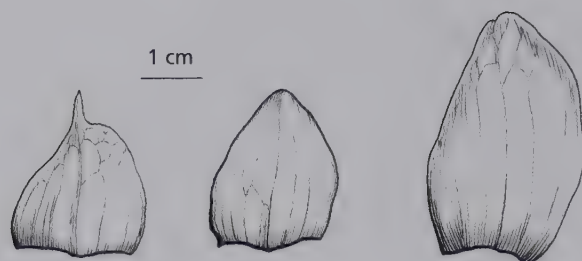


Fig. 5.24B. *Paeonia coriacea* Boiss.: involucrate bracts and sepals, based on D. Y. Hong & A. Quintanar H03018 (A, CAS, K, MO, PE). Drawn by Miss LI Ai-Li.

Humphris 60 (BM); Azrou, Middle Atlas, Goring-by-Sea Mts, c. 1,200 m, Apr. 1936, F. C. Stern s.n. (K); Aguelmane Azigza, *Cedrus* forests, 21 May 1981, S. Castroviejo, J. Fdez Casas, F. Muñoz-Garmendia & A. Susanna, FC4885 (G, MA). **TETOUAN PROV.:** Bab Taza, 35°05'N, 5°09'W, 1,400 m, 22 June 1980, F. Jacquemoud & D. Jeanmonod, Mar1165 (G); Bab Taza, Mt Lakraa, 1,480 m, 30 May 1981, S. Castroviejo,

J. Fdez Casas, F. Muñoz-Garmendia & A. Susanna, FC5403 (G, MA); Northern Atlas, Mt Sidimquid, 2,100 m, *Cedrus* forests, May 1924, E. Jahandiez 336 (BM, G, P); Mt Tisouka, above Xaen, limestones, 1,400–1,600 m, 5 July 1973, Davis 54831 (BM); Rif, Mt Tazout, 35°16'N, 5°07'W, 1,650 m, *Abies* forests, limestones, 29 May 1994, J. Lambinon 94/Ma/486 (MA). **SPAIN, CADIZ:** Sierra de Grazalema, Sierra del Pinar, El Torreón, 1,600 m, 18 Aug. 1983, A. Aparicio & J. G. Rowe s.n. (MA); Sierra del Endrinal, 1,400 m, 2 June 1984, A. Aparicio & J. Balzquez TF8768 (MA); Grazalema, 1,000 m, 3 Oct. 1976, A. Segura Zubizarreta 14.847 (MA). **CIUDAD REAL:** Puebla de D. Rodrigo, Valle Horcajo, 590 m, *Quercus pyrenaica* forests, 15 May 1999, J. L. Rodríguez Marzal s.n. (MA). **GRANADA:** Sierra de Alfacar, 22 July 1883, N. H. Nilsson 1600 (BM, LD, WU); *loc. eodem*, 1,300–1,500 m, 3 May 1925, H. Zerny s.n. (W); *loc. eodem*, 12 Aug. 2003, D. Y. Hong & A. Quintanar H03018 (A, CAS, K, MO, PE); Sierra de Alfacar, Alfacar, Sanatorio de la Alfaguara, 1,460 m, 20 June 1992, Aedo, Muñoz-Garmendia & C. Navarro CN-520 (MA); *loc. eodem*, 20 June 1992, Aedo, Muñoz-Garmendia & C. Navarro CN-521 (MA); *loc. eodem*, 1,250 m, 13 May 1979, F. Pérez Raya s.n. (MA); *loc. eodem*, Teja Fountain, 1,240 m, 20 June 1992, Aedo, Muñoz-Garmendia & C. Navarro CN-445 (MA); *loc. eodem*, 27 Apr. 1977, F. Vale s.n. (MA); Sierra de Alfacar, Alfaguara, 2 June 1973, J. Hurtado s.n. (MA); Sierra de Alcaraz, 1,000–1,400 m, June 1891, Porta & Rigo 343 (WU). Sierra Nevada: 14 July 1948, V. H. Heywood & P. H. Davis 754 (BM); *loc. eodem*, 14 June 1926, A. J. Wilmott & T. A. Lofthouse s.n. (BM); *loc. eodem*, June 1901, L. W. Lam s.n. (BM); *loc. eodem*, 23 Aug. 1974, H. Merxmüller & W. Lippert 29603 (M); Sierra Nevada, San Geronomo, 28 June 1851, E. Bourgeau 10052 (P); Sierra Nevada, June 1852, E. Bourgeau s.n. (E); Sierra Nevada, Trevenque, 1,700 m, 20 July 1974, A. Charpin & J. Fdez. Casas s.n. (MA); Sierra de Almijara, 1,400–1,650 m, 7 Aug. 1978, G. López 882 GF (MA); Sierra Nevada, San Geramina, 22 July 1876, M. Winkler s.n. (WU). Malatitana, S Prieta, 1,300–1,400 m, 21 June 1879, Porta & Rigo 862 (BM, BP, WU). **JAEN:** Sa de la Cabrilla, 10 June 1980, G. Blanca & F. Valle s.n. (MA). **MALAGA:** Sierra de Ronda, between Grazalema and Timera, 700–800 m, 7 June 1895, Porta & Rigo 20 (B, BP, K, WU); Sierra de Ronda, Puerto del Viento, 29 June 1849, E. Bourgeau s.n. (BM); Sierra de Tejeda, 2 June 1931, C. Vicioso s.n. (MA); Sierra del Torcal, Antequera, 16 May 1931, C. Vicioso & L. Ceballos s.n. (MA); *loc. eodem*, 1,200 m, 28 June 1974, G. López & E. Valdes-Bernejó 1636 GF (MA); Sierra de Ronda, 13 May 1889, E. Reverchon s.n. (E); *loc. eodem*, 9 Aug. 1889, E. Reverchon s.n. (E); Ronda, 1,000 m, limestones, 7 May 1964, C. M. Stocken 35864 (E); Sierra de Grazalema, 8 June 1908, E. Reverchon 346 (BM, G, K, P, WU); Baetica, Sierra del Pinar, 1,500 m, 11 July 1925, Font Quer s.n. (BC); *s. loc.* 1,100–1,200 m, 27 May 1983, E. Bayer & J. Grau B. G. 258 (M).

25. *Paeonia algeriensis* Chabert, *Bull. Soc. Bot. France* 36: 18 (1889). TYPE: Algeria, Mt Babor, 1888, L. Trabut s.n. (holotype P!; isotypes G!, P!)

Paeonia atlantica Trab., *Bull. Soc. Bot. France* 36: 62 (1889), nom. nud.

Paeonia corallina Retz. var. *atlantica* Coss., *Comp. fl. atlant.* 2: 54 (1887). *Paeonia corallina* Retz. subsp



Fig. 5.25A. *Paeonia algeriensis* Chabert: **a**, a lower leaf; **b**, densely villose lower surface of a leaf; **c**, a flower with three anterior petals removed, showing the single carpel; **d**, a flower showing disk and a nearly mature follicle. Drawn by Miss CAI Shu-Qin.

atlantica (Coss.) Maire, *Fl. Afriq. nord.* 11: 30 (1964). *Paeonia mascula* (L.) Mill. subsp. *atlantica* (Coss.) Greuter & Burdet, *Willdenowia* 12(2): 198 (1982). *Paeonia coriacea* Boiss. var. *atlantica* (Coss.) Stern, *J. Roy. Hort. Soc.* 68: 128 (1943); Stern, *Study Gen. Paeonia*, 90 (1946). TYPE: Algeria: Kabylie Orient. Mt Babor, 1,300 m, above Fraquens, 21 July 1861, L. Kralik 99 (holotype P!; isotypes BM!, G!, K!, MPU!)

Paeonia russoi Biv. var. *coriacea* (Boiss.) Coss. ex Batt. in Battandier & Trabut, *Fl. Algérie* 1: 18. 1888, pro parte, quoad pl. Alger.

Perennials. Roots unknown. Stems more than 50 cm tall, 0.7–1.0 cm in diameter. Lower leaves biternate with one or several of 9 leaflets segmented and thus with 10–13 leaflets/leaf segments; petioles always villose; leaflets/leaf segments ovate or oblong, rounded or broad-cuneate at the base, acute at the apex, 9–18 cm long, 5.5–9.5 cm broad, always moderate to densely white-villose beneath. Flowers solitary and terminal; involucre bracts 1, leaf-like, or absent; sepals 3 or 4 in number, orbicular or oblong-orbicular, all rounded at the apex, glabrous, purple inside and at the periphery, 2.5–3.5 cm long, 2–2.5 cm wide; petals pink or red, 5–6 cm long, 3–4 cm wide, rounded at the apex; disk c. 1 mm high, slightly waved, glabrous; carpels mostly single, less frequently 2 in number, nearly always glabrous, very occasionally sparsely hairy; styles 1–3 mm long; stigmas red, 2–3 mm wide. Follicles columnar, 4–5.4 cm long. Seeds black, ovoid-oblong, 9 mm long, 7.5 mm in diameter, seed-coat foveolate. Figs 5.25A, 5.25B.

PHENOLOGY. Flowering from middle May to late June.

CHROMOSOMAL NUMBER. Unknown (the only species of *Paeonia* whose chromosome number is still unknown).

HABITAT AND DISTRIBUTION. Growing in broad-leaved or mixed broad-leaved and coniferous forests with calcareous soils at altitudes of 1,100–2,000 m. A narrow endemic of Algeria, N Africa, and only along the coastal mountain range, Kabylie, concretely in the Babor Mountain, Magris Mountain, Djurdjura Mountain, and in the vicinity of Tala-Kitane and Kefrida (Map 5.25).

NOTES. The peony in Algeria has been taxonomically variously treated. Cosson (1887), Maire (1964), and Greuter & Burdet (1982) recognised it as a variety or subspecies in *Paeonia mascula* (= *P. corallina*), Battandier (1888) treated it as *P. russoi* var. *coriacea*, whereas Stern (1943, 1946) treated it as a variety within *P. coriacea*. We examined a total of 16 collections from 13 herbaria, a total of 51 sheets with 65 individuals (or stems). The carpels of the peony in Algeria are nearly always glabrous (54/61, i.e. 88.5%). Carpel numbers are the smallest in sect. *Paeonia*, mostly single (57%), less frequently two (43%). The follicles of this peony are the largest in sect. *Paeonia*, 4–5.4 cm long. The petioles and lower leaf surfaces are always villose, and the lower leaves have 10–13 leaflets/leaf segments which are 9–18 cm long and 5.5–9.5 cm broad, larger than those of its close relatives. Therefore, *P. algeriensis* Chabert is a distinct species. *Paeonia mascula* (L.) Mill. differs from it in having carpels numbering mostly 3–4, rarely 1–2, occasionally 5, which are always lanate, and leaves that are usually glabrous or very sparsely hispid beneath. *Paeonia coriacea* Boiss. is different from the peony in Algeria in having leaves that are glabrous, very occasionally hairy beneath, carpels numbering 1–4, but mostly 2 (52%) or 1 (28%), and smaller follicles and leaflets/leaf segments. *Paeonia corsica* Sieber ex Tausch (a diploid) has 3–4 carpels, less frequently 2 or 5, very occasionally 1, which are usually tomentose, and leaflets/leaf segments that mostly number 9 and are smaller in size.



Map 5.25. Distribution of *Paeonia algeriensis* Chabert.



Fig. 5.25B. *Paeonia algeriensis* Chabert: involucre bracts and sepals, based on *E. Cosson* s.n., 21 June 1880 from Mt Babor, Algeria (K). Drawn by Mr SUN Yin-Bao.

ADDITIONAL SPECIMENS EXAMINED. ALGERIA, Kabylie, Mt Babor: S side of summit ridge, 1,900 m, *Cedrus–Quercus* forests, limestones, 22 May 1971, *Davis* 52593 (BM); *loc. eodem*, summit, 21 June 1880, *E. Cosson* s.n. (K, P, US); *loc. eodem*, 1 July 1880, *E. Cosson* s.n. (K, P); *loc. eodem*, 1,700–2,000 m, *Quercus–Cedrus* forests, May 1917, *J. A. Battandier* s.n. (MPU); *loc. eodem*, 36°29'N, 5°27'E, 1,400–1,800 m, 15 June 1984, *D. Podlech* 39365 (G); *loc. eodem*, 1,700 m, limestones, in forests, May 1897, *E. Reverchon* 96 (G, MPU, P, WU). **CONSTANTINE PROV.:** *Quercus* forests, *J. A. Battandier* s.n. (MPU); near Kefrida, forests of Tedefelt, *J. A. Battandier* s.n. (MPU); Goubia(?), 24 July 1874, *Pomel* s.n. (MPU); Kabylie, 19 July 1961, *E. Cosson* s.n. (P); Kabylie, 1866, *G. Munby* s.n. (K). **ALGER PROV.:** Mt Djurdjura, eastern part, forests of Ait-Quabou, 1,600 m, June 1914, *J. A. Battandier* s.n. (MPU); *loc. eodem*, *Cedrus* forests of Ait-Quabou, 1,500–1,700 m, 31 May 1914, *R. Maire* s.n. (MPU); *loc. eodem*, l'det Ouabau forests, 31 May 1912, *G. Hibon* s.n. (P); Mt Magris, 1,600 m, limestones, May 1898, *E. Reverchon* 324a (BM, CAS, E, F, G, K, LD, M, MA, MPU, P, WU); *loc. eodem*, 1,600 m, July 1898, *E. Reverchon* 324b (BM, CAS, E, F, G, LD, M, MA, MPU, P, WU); near Tala-Kitane, 1,100 m, forests of l'Akfadou, 26 Oct. 1918, *R. Maire* s.n. (MPU).

IIIc. *PAEONIA* sect. *PAEONIA* subsect. *PAEONIA*

(species 26–32)

- 26. *Paeonia intermedia*** C. A. Mey. in Ledebour, Meyer & Bunge, *Fl. altaic.* 2: 277 (1830); Hong & Pan, *Ann. Missouri Bot. Gard.* 91: 95 (2004). *Paeonia anomala* L. var. *hybrida* Pall. f. *intermedia* (C. A. Mey.) Trautv., *Enum. pl. songor.* (Byull. Moskovsk. Obshch. Isp. Prir. Otd. Biol., 33): 88 (1860). *Paeonia hybrida* Pall. var. *intermedia* (C. A. Mey.) Krylov, *Fl. Altaya* 1: 47 (1901). *Paeonia anomala* L. subsp. *intermedia* (C. A. Mey.) Trautv. in Fedtschenko, *Trudy Glavn. Bot. Sada* 23: 351 (1904). *Paeonia anomala* L. var. *intermedia* (C. A. Mey.) B. Fedtsch. in O. & B. Fedtschenko, *Beih. Bot. Centralbl.* 18(2): 216 (1905); Pan, *Fl. Reip. Pop. Sin.* 7: 59, pl. 10 (1979). TYPE: Altai Mountains, *Ledebour* s.n. (lectotype designated by Hong & Pan 2004: 95, K!; isotype LE!).
- Paeonia intermedia* C. A. Mey. subsp. *pamiroalaica* Ovcz. in *Fl. RSS Tajikistan* 4: addenda 4, 531 (1975). *Paeonia anomala* L. subsp. *pamiroalaica* (Ovcz.) R. Cooper, *Survey Paeonia species*, 38 (1988). TYPE: Tajikistan: “declivitas australis jugi Hissaricic, ad ripam dextram fl. Maichura, 5 km ab ostio, 2,500 m”, 12 June 1971, *A. A. Glebova* 6 (holotype TAD, n.v.).
- Paeonia anomala* L. var. *hybrida* Trautv., *Enum. pl. songor.* (Byull. Moskovsk. Obshch. Isp. Prir. Otd. Biol., 33): 88 (1860) (non Pall.).
- Paeonia anomala* L. subsp. *hybrida* Halda, *Gen. Paeonia*, 102 (2004), syn. nov. (non Pall.).
- Paeonia hybrida* auct. non Pall.: Meyer in Ledebour, Meyer & Bunge, *Fl. altaic.* 2: 279 (1830); Krylov, *Fl. Altaya* 1: 46 (1901); Schipczinsky in Komarov, *Fl. USSR* 7: 34 (1937); Gamaulova in Pavlov, *Fl. Kazakhstan* 4: 13, tab. 2: 12 (1961).



Herbs perennial, up to 70 cm tall. Tap roots cylindrical, to 2 cm in diameter, woody when old; lateral roots thickened, tuberous, tubers spheroidal to long-fusiform. Lower leaves biternate, covered with bristles along veins above, always glabrous beneath; leaflets several times segmented; segments 70–100 in number, more-or-less decurrent at the base, linear, 6–16 cm long, 0.4–1.8 cm wide, sometimes lobed, acuminate at the apex. Flowers solitary, terminal; involucre bracts 3 in number, leaf-like, unequal in size; sepals 3–5 in number, often red-purple, ovate-orbicular, 1.5–2.5 cm long, 1–2 cm wide, mostly rounded (at least 2 non-caudate) at the apex, glabrous; petals 7–9 in number, purple-red, obovate, 3.5–5.5 cm long, 1.5–3 cm wide, irregularly incised at the apex; filaments purple; anthers yellow; disk annular, incised, up to 2.5 mm high; carpels 2–5, but mostly 3 in number, tomentose, rarely glabrous; stigmas sessile, 1 mm wide, red; ovules 12–16 per carpel. Follicles 2–2.8 cm long, 1.1–1.3 cm wide. Seeds black, glossy, long-ovoid, 5–5.5 mm long, 3–3.5 mm in diameter. Figs 5.26A, 5.26B.

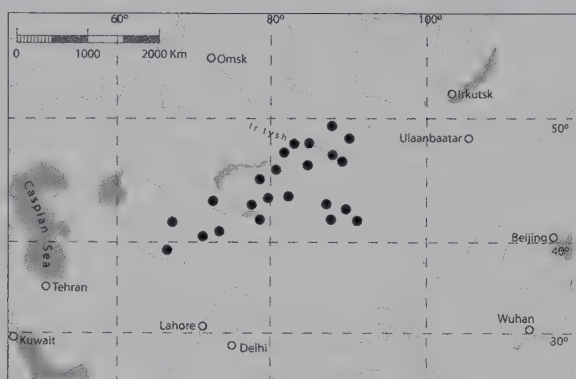
PHENOLOGY. Flowering from late May to late June; fruiting from August to September.

CHROMOSOME NUMBER. $2n = 10$ (Hong *et al.*, unpublished; the voucher: Xinjiang).

HABITAT AND DISTRIBUTION. Growing on grassy and shrubby slopes, in meadows, steppes, or sparse woods, at altitudes from 900 to 3,250 m. Widely distributed in N Xinjiang of China (S to the Tianshan), Kazakhstan, Kirghizia, Tajikistan, Uzbekistan, and the Altai of Russia (Map 5.26).

NOTES. Until Hong & Pan (2004), *Paeonia intermedia* had long been identified as *P. hybrida* (Krylov, 1901; Schipczinsky, 1921, 1937; Gamaulova, 1961), or treated as a variety of *P. anomala* (Fedtschenko & Fedtschenko, 1905; Stern, 1946; Pan, 1979), as a subspecies of *P. anomala* (Trautvetter, 1904), or even as a form of *P. anomala* var. *hybrida* (Trautvetter, 1860). These different and erroneous assignments were made because: (1) the identities of *P. anomala*, *P. intermedia* and *P. hybrida* were not clear to the authors mentioned above, (2) previous authors emphasised the taxonomic value of indumentum on carpels, and (3) the root and calyx characters and their correlation were ignored. Our examination of the types of these three taxa, together with extensive observations of herbarium specimens and natural populations, show that *P. intermedia* C. A. Mey. is an independent species, differing distinctly from *P. anomala* by its lateral tuberous to long-fusiform roots, and sepals that are mostly (at least 2 out of 3–5) rounded at the apex but not caudate (Hong & Pan, 2004: fig. 2c,d). In contrast to *P. anomala*, *P. intermedia* prefers relatively sunny and dry habitats. In *P. intermedia* carpels vary in number from 2 to 5, mostly 3, and from tomentose to rarely glabrous even within populations. Ovczinnikov (1975) properly treated the peony in Tajikistan as an element of *P. intermedia*, but his description of the new subspecies *pamiroalaica* is not justifiable. His description and our extensive observations have not revealed any significant difference from other populations. *Paeonia hybrida* Pall. has been shown to be a synonym of *P. tenuifolia* L. (Hong & Pan, 2004).

ADDITIONAL SPECIMENS EXAMINED. CHINA, XINJIANG, Mt Altai, N slopes, 1,500 m, 16 July 1959, *Acad. Sin. Xinjiang Integrated Exped.* 10657 (PE). Altay: Qiao'ati, 1,550 m, sunny slopes, 18 Aug. 1964, G. L. Zhu *et al.* 6325 (PE) and 6386 (PE); on the way to Halamai, 1,200 m, 29 Apr.



Map 5.26. Distribution of *Paeonia intermedia* C. A. Mey.

Fig. 5.26A (opposite). *Paeonia intermedia* C. A. Mey.: **a**, the lower part of the plant, showing tuberous roots, caudex and scales at the base of the stem; **b**, the upper part of the plant; **c**, a lower leaf; **d**, a flower with petals and stamens shed; **e**, the upper surface of a leaf, showing bristles along veins. Drawn by Miss LI Ai-Li.

1959, *Acad. Sin. Xinjiang integrated Exped.* 10227 (PE); Klasugou, 1,450 m, stony grassy slopes, 26 Aug. 1956, R. C. Ching 2433 (PE); *loc. eodem*, 1,450 m, Kelimu 2443 (XJBI); Haxiongou, 2,120 m, T. Y. Chou 652100 (XJBI); Mt Halamai, 1,300 m, *Berberis-Spiraea* bushes, D. Y. Hong *et al.* Population No. 2 (PE); Xiaodonggou, 1,000 m, *Berberis-Spiraea* bushes, D. Y. Hong *et al.* Population No. 4 (PE); *loc. eodem*, base of slopes, forests, 1,000 m, 18 May 2002, J. F. Mao, J. Pan & C. Wang XJ003 (PE); *loc. eodem*, sunny and stony slopes, 1,050 m, 21 May 2002, J. F. Mao, J. Pan & C. Wang XJ054 (PE). **Barkol**, Nanshan, 2,100 m, *s. coll.* 780 (XJBI). **Burqin**, Burqin to Kanasi Lake, 1,000 m, meadows, 19 May 2002, J. F. Mao, J. Pan & C. Wang XJ024 (PE). **Fuhai**: Fuhai Forest Farm, 1,100 m, sunny stony slopes, 1 Aug. 1964, G. L. Zhu 5665 (PE); N slope, in bushes, 1,700 m, T. Y. Chou *et al.* 652150 (PE, XJBI). **Fukang**: Tianci, Shimen, 1,300 m, D. Y. Hong *et al.* 0190 (PE); *loc. eodem*, 1,500 m, July 1964, J. C. Zhao s.n. (PE, XJU). **Fuyun**: Mica No. 3 Mine, *Integrated Exped.* s.n. (XJBI); Mica No. 4 Mine, under forests, 1,500 m, *Integrated Exped.* s.n. (XJBI); *s. loc.*, under *Betula* forests, 1,200 m, *Acad. Sin. Bot. Inst. Exped. to Xinjiang* 1803 (PE, XJBI). **Habahe**: Habahe Town to Haba Village, W slopes, 1,560 m, 20 May 2002, J. F. Mao, J. Pan & C. Wang XJ038 (PE). **Tielieke**: mountain shrubby meadows, 900 m, Kelimu 10171 (XJBI); *loc. eodem*, shrubby meadows, 1,300 m, Kelimu 10369 (XJBI); Wuzliti, mountain shrubby meadows, 1,700 m, Kelimu 10614 (XJBI). **Hoboksar**: S. S. Gou, *s. coll.* 7385 (XJBI); Mt Qiaganebo, 2,000 m, 22 June 1959, *Integrated Exped.* 10563 (PE, XJBI). **Huocheng**: Xin'ertai, Yeguolin, 1,300 m, C. W. Chang *et al.* 3316 (XJBI); Xin'ertai to Yining, Guozigou, 1,400 m, 10 Aug. 1974, Y. R. Ling 74849 (PE); Xin'ertai, Yangfengchang, 1,500 m, sunny grassy slopes, 22 June 1965, T. Y. Chou *et al.* 650868 (PE, XJBI); *loc. eodem*, Guozigou, 1,300 m, in forests of sunny slopes, Y. R. Ling 74243 (PE); Xiaoxigou, 1,400 m, shaded grassy slopes, 16 May 1959, A. R. Li & J. N. Zhu 10414 (PE, XJBI); Daxigou, 1,200 m, forests, 15 May 1959, *Acad. Sin. Exped.* 10402 (PE); *loc. eodem*, 1,400 m, Y. T. Shen 4860131 (XJNU); Aksu Commune, 1,400 m, 10 Aug. 1974, Y. R. Ling 74848 (PE); *loc. eodem*, 1,300 m, C. W. Chang *et al.* 4037 (XJBI). **Mori**, Nangou, 2,270 m, SW slopes, 17 June 1956, S. L. Chen 0040 (PE). **Qapqal**, 58 km from Yining to Zhaosu, *Inst. Biol. & Ped.* 66 (XJBI). **Qitai**: Biliuhe, 2,400 m, sunny grassy slopes, 29 June 1982, J. C. Zhao 82-4288 (PE, XJU); *s. loc.*, 2,300 m, *Acad. Sin. Xinjiang Branch, Integrated Inst. Hydr. Ped. & Biol.* 5915 (XJBI); Yuejin Township, 1,780 m, S. Q. Lin *et al.* 34 (XJBI); Kuangou, *Biology Exped.* 81-8381574 (XJBI); *loc. eodem*, *Biology*

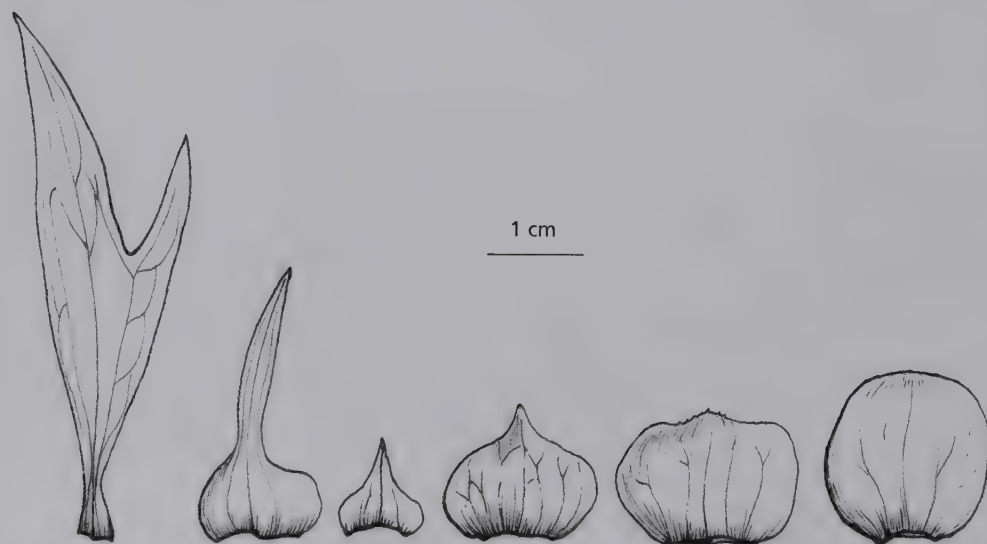


Fig. 5.26B. *Paeonia intermedia* C. A. Mey.: involucre bracts and sepals, based on T. Y. Zhou 650392 (PE). Drawn by Miss LI Ai-Li.

Exped. 81-8330478 (XJBI); *loc. eodem*, mountain forest meadows, *Biology Exped.* 79250198 (XJBI); *loc. eodem*, N. R. Cui 848 (XJBI); Tangfangmen Forest Farm, 2,300 m, *Integrated Inst. Hydr., Ped. & Biol. Resources* 5788 (XJBI). **Tacheng:** Mt Baerleike, N slopes, 1,500 m, *Integrated Exped.* 1200 (XJBI); *loc. eodem*, 1,400 m, X. Y. Li 870169 (SHI). **Toli,** Mt Albakzin, slopes, 7 Aug. 1957, K. C. Kuan 2611 (PE, XJBI). **Xinyuan:** Nanshan, 1,200 m, grassy slopes, 18 May 1965, T. Y. Chou *et al.* 650392 (PE); *s. loc.*, Xinjiang "8.1" *Agr. Coll.* 1051 (PE). **Yining:** Yining Forest Farm, Jartoulung Valley, 1,150 m, in sparse *Prunus-Malus* forests, 31 May 1993, D. Y. Hong *et al.* *Population* 1 and 092 (PE). **Yumin,** The Wild Bada *Prunus* Nature Reserve, 2,950 m, in sunny bushes, 12 May 1985, J. C. Zhao 85-293 (PE, XJU). **KAZAKHSTAN, E KAZAKHSTAN:** Kalbinsky Mountain Range, Mt Kok-tau, near Sabinskie Lake, 5 July 1965, A. Yunatov 24 (LE). **SEMIPALATINSK PROV., Zaisan Distr.:** Kusto Gorge, bushes, 24 May 1914, B. Shishkin s.n. (LE); near Kenderlyk, rocky plains, 1 June 1914, B. Shishkin s.n. (LE); near Zaisan, Mt Kichken-tau, 22 June 1930, Tatarowa & Borsowa 52 (LE). **MOUNTAIN KAZAKHSTAN:** Tsarytsynsky Mountain Pass, deep gorge from the pass, 25 July 1930, N. V. Schipczinsky 125 (LE); Western ridges of Songorian Alatau, Koksui Gorge, near Koksuisky, 20 June 1959, V. Goloskokov s.n. (LE); *loc. eodem*, Mt Katurkain, upper reaches of Karagaily River, grassy slopes, 28 June 1959, V. Goloskokov s.n. (LE); Tarbagatai, Chenarak, steppes, 22 Aug. 1931, Grigoriev & Buhaeva 298 (LE). **SEMIRECHENSK PROV.,** Songorian Alatau, S of Lepsinsk, R. Rozhevits 55 (LE); *loc. eodem*, Kibirny stream, grassy slopes, 5–20 May 1915, T. Tripolitova s.n. (LE); N slope of Alatau, between Verny to Kastek mountain pass, May 1896, V. Ladygin, s.n. (LE). **ILI-PRIBALKHASH:** SW Songorian Alatau, Emelsky Mountain Range, Mt Matai, meadows, 20 June 1956, V. Goloskokov s.n. (LE). Zailiisky Alatau, Usun-Kargali River Valley, W Sukonnaya Fabrika, bushy slopes, 13 May 1963, V. Goloskokov s.n. (LE). NW ridges of Kirgizsky Mountain Range, upper reaches of Sugata River, bushy meadows, 7 June 1963, V. Goloskokov s.n. (LE). **ISSYK-KUL PROV.,** Santash, Dongulsky garden, meadows, 18 July 1954, Aidarova & Kashenko s.n. (LE). **TALDY-KURGAN PROV.,** Altyn-Emel Mountain Range, Engi-Altyn-Emel Mountain Pass to Sary-Ozek-Dzharkent, rocky slopes, Grubov & Luboarsky 229 (LE). **S KAZAKHSTAN:** Prichuisky Mujun(Kum), Sulunger Gorge, rocky slopes, 2,000 m, meadow-steppes, 1 June 1930, F. Zapriagaev 66 (LE). **Chatkalsky Mountain Range,** Chatkal Valley, Mt Piazak, subalpine zone, 5 Aug. 1939, O. Knorring 60 (LE). **Alma-Ata,** Mt Zailiisk, 1,400–1,750 m, 30 May 1974, V. Vašák s.n. (G). **KIRZHIGIA: SEMIRECHENSK PROV.,** Pishpeksky Distr., Uzungyrskaya Volost, Aleksandrovsky Mountain Range, Mt Shekule, N slope, 4 May 1916, A. Savenkova 29 (LE). **DZHALALABAD PROV.:** Bazar-Kurgan Distr., Fergansky Mountain Range, S slopes, near AK-Terek, 5 June 1955, Lebedeva & Faleeva s.n. (LE); *loc. eodem*, Mt Alash-bashi, alpine meadows, 8 July 1945, Fedorov & Iljina 72 (LE); *loc. eodem*, 10 July 1945, Fedorov & Iljina 128 (LE). Tianshan, Ketmen Mountain Range, Mt Elchin-Ustriuk, Kizilbulak Gorge, subalpine meadows, 14 Aug. 1963, *s. coll.* s.n. (LE). Kara-Alma, Toguz (Bulak), 1,800 m, N slopes, Poniatovskaya s.n. (LE). **FERGANA PROV.,** Oshsky Distr., Ak-Bura Valley, Kanida Mountain Pass, May 1913, O. Knorring 25 (LE). **Kirgizsky Alatau,** Makbal Gorge, Ty-Karyn River, 9 June 1931, G. Igolkin 97 (LE). **RUSSIA: ALTAI:** 1840, A. Shrenk s.n. (LE). **BARNAUL PROV.:** between Kalmytskie Mysy and Mahanova, steppes, 11 June 1913, P. Krylov s.n. (LE); Gorno-Altaysk Autonomous Oblast, near Barlak, along Syema River, steppes, 750 m, 18 Aug. 1978, T. S. Elias, W. Webber, C. S. Tomb & I. M. Krasnoborov 4232 (PE). **TAJIKISTAN: Gissarsky Mountain Range:** Varzob Valley, right bank of Maihur Gorge, NE slopes, 2,000 m, 19 June 1964, Stepanenko & Kudriashova 2514 (LE); *loc. eodem*, N stony slopes, grasses and bushes, 2,200 m, 17 July 1976, Ikonnikov & Fridman 892 (LE); Semichat River, near Dara, 2,020 m, broad-leaved forests, 17 June 1934, A. Koroleva & V. Nikitin 138 (LE); mountain pass between Havag and Ketsgug Rivers, 22 Sep. 1928, N. Gontscharow 2051 (LE); upper part of Horanchon Gorge, stony slopes, 1,800 m, Zapriagaev 351 (LE). **Buhara:** Gissar, Zarkamar Mountain Pass, 3,250 m, 27 July 1896, V. Lipsky 1697 (LE); Buhara, Karategin Prov., Peter the Great Mountain Range, Kamchirak Mountain Pass, 22 June 1911, A. Golbek 158 (LE). **Vahshsky**

Mountain Range, Mt Hozreshi-Sho, above Sary-Hosor, 24 June 1957, *Sidorenko* 185 (LE). **Darvazsky Mountain Range**: N slope, left bank of Zarako River, opposite Havdak, 9 June 1966, *Shinova & Kinzikaeva* 1550 (LE). Mt Imam-askari, W of Darai-Imam, 6 June 1960, *Bochantsev & Egorova* 1014 (LE). Nazarak Valley, upper reaches, 15 km S of Tadzhibakabad, N slopes 2,650 m, meadows, 25 July 1976, *Ladygina, Ikonnikov & Fridman* 1337 (LE). **UZBEKISTAN, TASHKENT PROV.**: Bolshoy Chimgan, grassy slopes, 5 June 1914, *Z. Von Minkwitz* 1190 (LE); *loc. eodem*, N stony slopes, 25 June 1959, *V. Bochantsev* 547 (LE). **Tian-Shan**, Chatkalski Khrebet Mts, Mt Chimgan, 1,850–2,900 m, 20 July 1973, *V. Vašák* s.n. (W).

27. *Paeonia tenuifolia* L., *Syst. nat.* edn 10, 2: 1079 (1759) and *Sp. pl.* edn 2, 1: 748 (1763); Pallas, *Fl. ross.* 1(2): 95, tab. 87 (1788); Sims, *Bot. Mag.* 24: tab. 926 (1806); de Candolle., *Syst. nat.* 1: 394 (1818) and *Prodr.* 1: 66 (1824); Anderson, *Trans. Linn. Soc. London* 12: 262 (1818); Rochel, *Pl. Banat. var.*, 48, tab. 12, fig. 26 (1828); Boissier, *Fl. orient.* 1: 98 (1867); Lynch, *J. Roy. Hort. Soc.* 12: 434, fig. 26 (1890); Huth, *Bot. Jahrb. Syst.* 14(3): 271 (1891); Gürke in Richter, *Fl. eur.* 2: 403 (1903); Schipczinsky in Komarov, *Fl. USSR* 7: 34 (1937); Stern, *J. Roy. Hort. Soc.* 68: 130 (1943); Stern, *Study Gen. Paeonia*, 110, cum tab (1946); Cullen & Heywood in Tutin *et al.*, *Fl. Europ.* 1: 243 (1964); Akeroyd in Tutin *et al.* (eds), *Fl. Europ.* edn 2, 1: 293 (1993); Krupkina in Tzvelev (ed.), *Fl. Europ. orient.* 9: 172 (1996); Hong & Zhou, *J. Linn. Soc. Bot.* 143: 143 (2003). TYPE: N° 692.4 (lectotype designated by Schmitt, 2003: LINN!; photo F!).

Paeonia tenuifolia L. var. *laciniata* Salm-Dyck, *Hort. Dyck.*, 371 (1834).

Paeonia tenuifolia L. var. *latisecta* Neilr., *Aufz. Ungarn Slavon. Gefässpf.*, 70 (1870). *Paeonia tenuifolia* L. f. *latisecta* (Neilr.) Borza, *Consp. Fl. Roman. Reg. Aff.* 1: 94 (1947).

Paeonia tenuifolia L. var. *parviflora* Huth, *Bot. Jahrb. Syst.* 14: 271 (1891). *Paeonia tenuifolia* L. f. *parviflora* (Huth) Borza, *Consp. Fl. Roman. Reg. Aff.* 1: 94 (1947). TYPE: Romania, Dobrukscha, Babadagh, 9 May 1874, *Sintenis* 906 (holotype BP!).

Paeonia tenuiflora L. var. *typica* Schipcz., *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 2: 46 (1921).

Paeonia hybrida Pall., *Fl. ross.* 1(2): 94, tab. 86 (1788). *Paeonia tenuifolia* L. var. *hybrida* (Pall.) Lipsky, *Fl. caucasi*, 235 (1889). TYPE: The specimen with handwriting “*Paeonia hybrida*, Flora Rossica, tab. 86” (lectotype designated by Hong & Pan, 2004: 89, fig. 1B. BM!).

Paeonia multifida Gueldenst., *Reis. Russland* 2: 19 (1791).

Paeonia biebersteiniana Rupr., *Mém. Acad. Imp. Sci. St.-Petersburg*, ser. 7, 15(2) (*Fl. caucasi*): 47 (1869); Lipsky, *Trudy Tiflissk Bot. Sada (Fl. caucasi)* 4: 214 (1899); Schipczinsky in Komarov, *Fl. USSR* 7: 35 (1937); Grossheim, *Fl. Kavkaza* 4: 13 (1950); Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 31 (1961). *Paeonia tenuifolia* L. var. *biebersteiniana* (Rupr.) N. Busch, *Fl. Caucas. Crit.* 3(3): 9 (1901) and 224 (1903); Grossheim, *Fl. Kavkaza* 2: 91 (1930). *Paeonia tenuifolia* L. subsp. *biebersteiniana* (Rupr.) Halda, *Acta Mus. Richnov., Sect. Nat.* 4(2): 29 (1997) & *Gen. Paeonia*, 115 (2004). TYPE: Russia, near Stavropol, *M. Bieberstein* s.n. (holotype LE!).

Paeonia carthalinica Ketsk., *Notul. Syst. Geograph. Inst. Bot. Tiphlis* 21: 18, fig. 3. 1959; Kemularia-Nathadze, *Trudy Tbilissk Bot. Inst.* 21: 30 (1961). TYPE: Georgia, Kartli, Tirdznissi Village, 10 May 1958, *N. Ketskovi* s.n. (holotype TBI!).

Paeonia lithophila Kotov, *Ukrain. Bot. Zhurn.* 13(3): 49, fig. 1 (1956) and *Ukrain. Bot. Zhurn.* 28: 609 (1971). TYPE: Ukraine, “dit. Taurica”, Sudak Distr., Karadagh, Mt Sancta, 23 May 1948, *M. Kotov & E. Karnauch* s.n. (holotype KW, n.v.)

Fig. 5.27A (opposite). *Paeonia tenuifolia* L.: **a**, the lower part of the plant, showing tuberous roots, caudex and scales at the base of the stem; **b**, the upper part of the plant and a flower with petals and stamens shed, showing disk and carpels; **c**, a lower leaf; **d**, the upper surface of a leaf, showing bristles along veins. Drawn by Miss LI Ai-Li.



Paeonia tenuifolia L. f. *brevifolia* (Prodan) Borza, *Consp. Fl. Roman. Reg. Aff.* 1: 94 (1947). TYPE: not designated.

Paeonia tenuifolia L. f. *latifolia* (Prodan) Borza, *Consp. Fl. Roman. Aff.* 1: 94 (1947). TYPE: not designated.

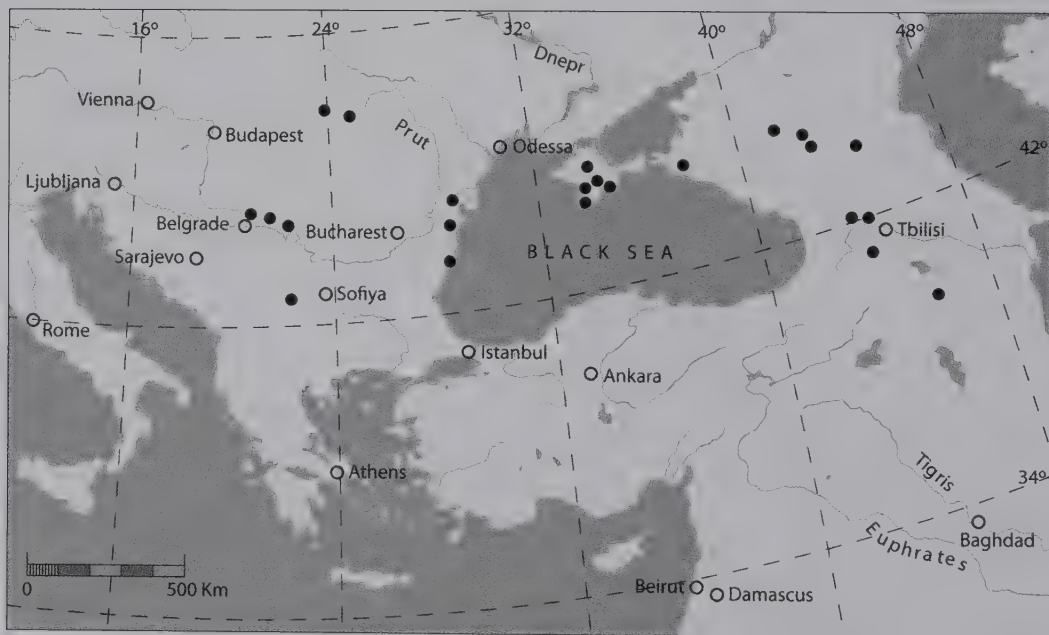
Paeonia tenuifolia L. f. *normalis* A. Nyár. in Savulescu, *Fl. Reip. Pop. Roman.* 2: 675 (1953). TYPE: not designated.

Perennials 18–60 cm tall. Tap roots elongated, not thickened, up to 1 cm thick, lateral roots always tuberous, with tubers fusiform, oblong or even spherical. Caudex branched, 2–6 cm long; stems glabrous. Lower leaves triternate, leaflets segmented several times; segments 134–340 in number, linear or filiform, final segments 0.5–3.8 cm long, 0.5–8 mm wide, glabrous on both sides, but sometimes covered with bristles along veins above. Flowers solitary and terminal; involucre bracts 1–3 in number, leaf-like; sepals 4 or 5, rarely 3 in number, all rounded or one, or occasionally two of them, caudate at the apex, 1–1.5 cm long, 0.7–1 cm wide, green but purple-red at the periphery or entirely purple-red, densely hispidulous, rarely glabrous on the abaxial side; petals 6–8 in number, consistently red, obovate, 2–4 cm long, 1.5–2 cm wide, rounded, 2-lobed or incised at the apex; filaments entirely yellowish white, pink below but yellowish white above to entirely purple-red; anthers yellow; disk fleshy, waved, 1 mm high, yellow; carpels 1–3, but more frequently 2 in number, ovoid, always tomentose, hairs green, yellow to totally purple-red, c. 1 mm long; stigmas sessile, red, 1–1.5 mm wide. Follicles ovoid. Figs 5.27A, 5.27B.

PHENOLOGY. Flowering from middle April to late May; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 10$ (Punina, 1987, 1989; Stebbins, 1938a; Stern, 1944; Zhang & Sang, 1999; the present work with the voucher: Russia, Stavropol, D. Y. Hong & S. L. Zhou H99052 (A, CAS, K, MO, PE, US)).

HABITAT AND DISTRIBUTION. Usually growing in steppes, meadows, open sandy dunes, shrubs, or at the edges of forests. *Paeonia tenuifolia* seems to prefer dry habitats, and was found growing at lowlands below an altitude of 900 m. Armenia, Azerbaijan, Bulgaria, Georgia, Romania, Russia (the Caucasus), Serbia, Turkey (European part) and Ukraine (Map 5.27).



Map 5.27. Distribution of *Paeonia tenuifolia* L.



Fig. 5.27B. *Paeonia tenuifolia* L.: involucre bracts and sepals, based on D. Y. Hong & S. L. Zhou H99028 (A, CAS, K, MO, PE, US). Drawn by Miss LI Ai-Li.

NOTES. *Paeonia tenuifolia* as circumscribed here is a very distinct species. It has the finest leaflets/leaf segments and the greatest number of leaflets/leaf segments of any peony species. There is no intergradation with any other species. In Kartli, Georgia, it grows together with *P. daurica*. According to preliminary results from our DNA sequencing, *P. majko* Ketsk. is a hybrid between these two species.

Paeonia biebersteiniana was recognised as an independent species because it was described (e.g., by Schipczinsky (1937)) as having leaf segments that are wider than those of its close relatives. *Paeonia carthalinica* was distinguished from *P. tenuifolia* by its wider leaf segments and greyish pubescence on carpels. Hong and Zhou (2003) critically observed the variation of *P. tenuifolia* in three natural populations in the Caucasus. Leaf segments were found to vary continuously from 0.5 to 6.0 mm in width; even within an individual, three shoots had leaf segments of differing widths (1.5, 3.5 and 5.5 mm). The colour of hairs on the carpels was also very variable, from yellowish green to pink, red and purple red. Apparently, both *P. biebersteiniana* and *P. carthalinica* are within the variation range of *P. tenuifolia* (Hong & Zhou, 2003).

Even Anderson (1818: 263) discovered variation in the width of leaf segments. He stated, “The sterile or rather the radical leaves in rich ground almost constantly assume a linear-lanceolate form; indeed both descriptions of leaves (linear or linear-lanceolate) are frequently produced on the same root”, and thus, “*P. hybrida* of Pallas is not even a permanent variety”. Unfortunately, many later authors (Ruprecht, 1869; Lipsky, 1899; Busch, 1901; Schipczinsky, 1937; Kemularia-Nathadze, 1961; Halda, 1997, 2004) paid no attention to Anderson’s words, and still recognised *P. hybrida* and *P. biebersteiniana*.

When Kotov (1956) described *Paeonia lithophila* as new, he stated that the new species differed from *P. tenuifolia* in having shorter stems (10–20 cm), shorter leaf segments (1–8 mm long) and smaller carpels (ca. 1 cm long, 1–1.5 cm wide). We examined a topotype, Kotov & Karnauch 19 May 1948 (PE), which is 22 cm tall, with the longest final leaf segments reaching 12 mm. In addition, our collection D. Y. Hong & S. L. Zhou H99028 (from Kartli, Georgia) is 30–45 cm tall, with the longest

final leaf segments reaching 23–30 mm; H99043 (Kartli, Georgia) is 40–56 cm tall, with the longest final leaf segments reaching 25–38 mm; but H99052/53 (Stavropol, Russia) is 19–29 cm tall, with the longest leaf segments reaching 18–25 mm. It is clear that *P. tenuifolia* also varies both in height of stems and length of leaf segments, with H99043 at one extreme, the holotype of *P. lithophila* at the other extreme, and the topotype and H99052/53 in the middle, linking the two extremes.

ADDITIONAL SPECIMENS EXAMINED. ARMENIA, *s. loc.*, Szovitz s.n. (E); *s. loc.*, ex Herb. Mus. St-Petersburg (US). **AZERBAIJAN**, **S KARABAKH**: Zangelan, Kegnja-Pirtshevan, 26 May 1937, Grossheim s.n. (BAK) and 30 May 1937, Grossheim s.n. (BAK); Zangelan, near Pirchevan, 400 m, 7 May 1948, Grossheim et al. s.n. (LE); Zangelan, Pirchevan, 7 May 1948, Vasiljev s.n. (LE). **BULGARIA**, **Sofia**: 12 km W of Sofia, 22 May 1893, Reiser s.n. (B, G, W). **Cavarna**, 7 June 1924, I. Prodan s.n. (BUCA). **Dobruja**: N Balcic, 13 July 1931, F. Vierhappz s.n. (WU); c. 10 km W of Durankulak, 24 May 2000, A. Polatschek s.n. (W). **GEORGIA**, **Kartli**: between Igoethi and Lamiskana, 15 May 1958, N. Ketskovieli s.n. (E); between Igoeti and Lamiskana, 15 May 1958, Ketskovieli s.n. (LE); near Igoeti, 2 May 1985, Punina s.n. (LE); *loc. eodem*, 630 m, 2 May 1999, D. Y. Hong & S. L. Zhou H99028 (A, CAS, K, MO, PE, US); Mukhrani, near Dampalo Village, 760 m, S slope, on terraces, 5 May 1999, D. Y. Hong & S. L. Zhou H99043 (A, CAS, K, MO, PE, US). **ROMANIA**, **Banat**, Oravicza, Wierzbicki s.n. (GZU). **Constanta**: Murfatlar, 13 Apr. 1915, G. Grintescu s.n. (BUCA); Murfatlar, Wustanta, 27 Apr. 1905, A. Moehrlen s.n. (G); Gura County, 22 May 1965, G. Serbanescu s.n. (BUCA); Hazieni, 15 m, 5 July 1967, E. Topa s.n. (BC, WU); *s. loc.*, 14 Apr. 1959, C. Zahariadi s.n. (BUCA). **Klausenburg (Cluj)**, 20 June 1937, Baschant s.n. (B). **Mures**, Zau de Cimpie, June 1932, I. Prodan s.n. (BUCA). Caliacra Distr., near Ghiaursniucine, 24 Apr. 1938, Constanfrinid & P. Cretzoiu s.n. (G). **Siebenburnia**, 1878, J. Barth s.n. (B). **Temes**: 2 May 1896, J. Wagner s.n. (BP); 7 June 1897, Frawunda s.n. (BP). **Transylvania**: Mezö-Záh, May 1860, J. Wolff s.n. (G); *loc. eodem*, May 1860, Haynald s.n. (BP, G); *loc. eodem*, May 1890, J. Wolff s.n. (G, RO); *loc. eodem*, May 1844, J. Wolff s.n. (B); Transylvania, Frata, June 1854, V. de Janka s.n. (G); *loc. eodem*, 14 May 1868, V. de Janka s.n. (B, BM); *loc. eodem*, 4 May 1907, A. Richter s.n. (B, BC, BM, E, G, GZU, P); Transylvania, between Frata and Záh, Mt Bota, 14 May 1878, V. de Janka s.n. (BP, E, G, WU); *loc. eodem*, 18 May 1878, V. de Janka s.n. (BM); *loc. eodem*, Mt Bota, 23 Apr. 1876, V. de Janka s.n. (WU); *loc. eodem*, 14 May 1868, V. de Janka s.n. (B, BM, G, WU); *loc. eodem*, 15 May 1869, V. de Janka s.n. (B, G, WU); *loc. eodem*, 29 Apr. 1876, V. de Janka s.n. (BP, G); *loc. eodem*, 1844, G. & J. Wolff s.n. (B, G, GZU, PE, WU); *loc. eodem*, 1886, J. Wolff s.n. (B); *loc. eodem*, 400 m, May 1889, J. Wolff s.n. (B, E, RO, W, WU); *loc. eodem*, 4 May 1907, J. Wolff s.n. (RO); Mezö-Záh, May 1892, J. Wolff s.n. (BP); *loc. eodem*, 16 Apr. 1902, A. Richter s.n. (B); *loc. eodem*, 13 May 1900, A. Richter s.n. (B); *loc. eodem*, 23 May 1900, A. Richter s.n. (GZU); *loc. eodem*, 400 m, May 1886, J. Wolff s.n. (GZU, RO); *loc. eodem*, May 1890, J. Wolff s.n. (RO); *loc. eodem*, 14 May 1907, A. Richter s.n. (G); *loc. eodem*, 16 Apr. 1904, A. Richter s.n. (GZU); *loc. eodem*, 25 Apr. 1876, J. Barth s.n. (B, BP, GZU, RO, WU); *loc. eodem*, 1893, J. Wolff s.n. (GZU); *loc. eodem*, 25 Apr. 1876, Ipse s.n. (BP, G). **RUSSIA**, **Checheno-Ingushetia**, Terski Mountain Range, near Goragorski, 21 May 1974, Magulaev s.n. (LE). **Krasnodar**: Markotkh Mountain Range, near Kabardinka, 9 June 1989, Dolmatova et al. 1877 (LE); *loc. eodem*, 10 June 1989, Dolmatova et al. 1997 (LE); Tonnelnaya Station, the mountain pass from Krasnodar to Anapa, 2 June 1952, Fedorov s.n. (LE). **Kuba**: *s. loc.*, May 1889, Poltozotsky s.n. (WU); Gustie Hutora, 16 June 1926, Schiffers 342a (LE); Mt Shize, 21 Apr. 1907, Busch & Klopotoz s.n. (LE). **Novorossiisk**, Markotkh Mountain Range, 10 May 1921, Leonova 459 (LE). **Pyatigorsk**, 1910, Pastukhori s.n. (LE). **Stavropol**: *s. loc.*, 1867, Tzecker 56 (LE); *s. loc.*, 1867, Recuer s.n. (LE); *s. loc.*, Becker 4804 (BP); near Stavropol, 8 May 1972, Mordak & Zakhariava 1048 (LE); slope to Rybnoie Lake, 10 Aug. 1949, Vasilchenko 476a (LE); *loc. eodem*, July 1949, Vasilchenko 417 (LE); Rybnoie Lake, 28 May 1892, Lipsky s.n. (LE); Prikalausskie Heights, 4–6 km NW of Kruglolesskoye, 27 June 1988, Geltman et al. 1772 (LE); Stavropol Heights, 4–6 km NW of Kruglolesskoye, 27 June 1988, Geltman et al. 1772 (LE); Stavropol Height, Mt Strizhament, 700–800 m, 21 June 1988, Geltman 1476 (LE); Temnolesskaya,

44°52'N, 42°10'E, 630 m, 15 May 1999, D. Y. Hong & S. L. Zhou H99052 (A, CAS, K, MO, PE, US); *loc. eodem*, 15 May 1999, D. Y. Hong & S. L. Zhou H99053 (A, CAS, K, MO, PE, US). **Terskaya:** near Essentuki, 20 June 1912, Stuchenberg 15 (LE); *loc. eodem*, 19 May 1960, Andreev s.n. (LE); Usiskaya, Kubinskaya Stanitsa, 1889, Gagman s.n. (LE). **CAUCASUS:** *s. loc.*, Schnader s.n. (LE); Caucasus, Ledebour s.n. (LE); Caucasus, Fischer s.n. (LE); Caucasus, May 1842, R. T. Hohenacker s.n. (BP, G, P); Caucasus, Wilhelms s.n. (E, G); Caucasus, J. J. Roemer s.n. (BM); Caucasus, ad littoral Wolga lecta, J. J. Roemer s.n. (BM); Caucasus, Sarepta, Wunderlich s.n. (G). **SERBIA, Banat:** between Deliblat and Karlsdorf, 9 June 1887, A. de Degen s.n. (WU); Deliblat, Aug. 1898, J. Wagner s.n. (BC); Deliblat, c. 4 km E of Vladimirovac Station, 160 m, 10 June 1965, F. Wrigley 65–1262 (K); Deliblat, SW of Umgebung, c. 180 m, 9 July 1974, J. Poelt 3037 (GZU); *loc. eodem*, c. 180 m, 9 July 1974, J. Hafellener 1772 (GZU); *loc. eodem*, 9 July 1974, J. Hafellener 1773 (GZU); Ulma, May 1896, J. Wagner s.n. (G); between Ulma and Mramorak, 20 July 1887, L. Simkovics s.n. (BP); between Ulma and Grebenacz, 11 May 1840, Wierzbicki s.n. (BM, E, G); between Ulma and Karlsdorf, 11 May 1840, Wierzbicki s.n. (G); *loc. eodem*, 1840, E. Zador 1239 (BP); Karlsdorf, Flamunda, 12 May 1896, J. Wagner s.n. (BM, E, G); Grebenacz, 19 Apr. 1873, V. Borbas s.n. (WU). **UKRAINE, CRIMEA, Rhemotowo:** *s. loc.*, 30 June 1943, Raik 194 (B); Charkow, Staropjelsk Distr., edges of forests, May 1905, J. Schirajewsky s.n. (BM, BP); Luganski, Milovia Distr., Velykotzjke Village, steppes, 21 May 1956, Z. Saryczewa & E. Berezovczuk s.n. (E, G, K, PE); *loc. eodem*, 20 May 1956, Z. Saryczewa & E. Berezovczuk s.n. (K); *loc. eodem*, “Streletzkaja Step” Nature Reserve, 23 May 1952, D. Dobroczejawa s.n. (PE). **Simpferopol:** 26 May 1885, N. Zelenetzky s.n. (G); *loc. eodem*, 1893, Fedchenko s.n. (G); Neusatz, 14 Apr. 1900, A. Callier s.n. (WU); *loc. eodem*, 24 Apr. 1900, A. Callier 770 (B, G, WU); Rosenthal, 8 June 1895, A. Callier s.n. (WU); Dubki, 4 May 1905, N. Busch s.n. (BP, G, WU); Mt Barsuchia, near Perevalnoie, 500–900 m, 29 July 1977, V. Vašák s.n. (G, W); 10 km SW of Bakhchisaraj, 1 km N of Siren, 10 Aug. 1964, A. O. Chater 208 (BM); *s. loc.*, 18 July 1907, V. Sarandinaki s.n. (BP); Ai-Petri, 1 June 1899, K. Klementz 652 (BP, G, WU); Sudak, Karadag, 19 May 1948, M. Kotov & E. Karanach s.n. (PE); *s. loc.*, Trivaldsky s.n. (BP). **Stalinia,** Budjonovia, Chomutovo, “Chomutovskaja Step” Nature Reserve, 5 May 1955, G. Kusnetzova s.n. (PE).

28. *Paeonia peregrina* Mill., *Gard. dict.* edn. 8, No. 3 (1768); Sims, *Bot. Mag.* 26: tab. 1050 (1807), quoad nom.; Anderson, *Trans. Linn. Soc. London* 12(1): 277 (1818), quoad nom.; de Candolle, *Syst. nat.* 1: 390 (1818), quoad nom. and *Prodr.* 1: 66 (1824), quoad nom.; Baker in *Gard. Chron.* ser. 3, 21: 829 (1884), quoad nom.; Lynch, *J. Roy. Hort. Soc.* 12: 439 (1890), quoad nom.; Huth, *Bot. Jahrb. Syst.* 14(3): 270 (1891), quoad nom.; Stapf, *Bot. Mag.* 144: tab. 8742 (1918); Stern, *J. Roy. Hort. Soc.* 56: 72 (1931), *ibid.*, 68: 129 (1943); Stern, *Study Gen. Paeonia*, 97 (1946); Cullen & Heywood in Tutin *et al.*, *Fl. Europ.* 1: 243 (1964); Uspenskaya & Solovyeva, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 96: 131 (1991); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 293 (1993). *Paeonia officinalis* L. var. *peregrina* (Mill.) Martyn in Miller & Martyn, *Gard. dict.* edn 9, 2: No. 2 (1807). TYPE: Turkey: Renkoei, above Kuzkoei, 12 May 1883. *P. Sintensis* 334 (neotype designated by M. S. Uspensk. & Solovyeva 1991, LE; isoneotypes G!, K!, Pl!, WU!).

Paeonia decora G. Anderson, *Trans. Linn. Soc. London* 12(1): 273 (1818); Huth, *Bot. Jahrb. Syst.* 14(3): 269 (1891). TYPE: Serbia, Nisch, Apr. 1884, S. Petrovic s.n. (neotype here designated, BM!; isoneotype G!).

Paeonia decora var. *pallasii* G. Anderson, *Trans. Linn. Soc. London* 12(1): 274 (1818). TYPE: not designated!

Paeonia decora var. *elatiior* G. Anderson, *Trans. Linn. Soc. London* 12(1): 274 (1818). TYPE: not designated!

Paeonia lobata Desf. ex DC., *Syst. nat.* 1: 391 (1818), pro parte, quoad descr., de Candolle, *Prodr.* 1: 66 (1824), pro parte, quoad descr.; Desf., *Tabl. école bot.*, 126 (1804), nom. nud.



Fig. 5.28A. *Paeonia peregrina* Mill.: **a**, fusiform roots; **b**, the lower part of the stem; **c**, a lower leaf; **d**, the upper surface of a leaf, showing bristles along veins; **e**, a flower; **f**, a flower with petals and stamens shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.

Paeonia multifida Salm-Dyck, *Hort. Dyck.*, 369 (1834). TYPE: not designated!

Paeonia romanica D. Brândză, *Prodr. fl. Române*, 38 (1881) and *Anal. Acad. Romane*, ser. 2. 2: 587, tab. 2 (1881). TYPE: Brândză's tab. cited (holotype!).

Paeonia tartarica Mill., *Gard. dict.* edn 8, No. 5 (1768). *Paeonia officinalis* L. var. *tartarica* (Mill.) Martyn in Miller & Martyn, *Gard. dict.* edn 9, 2: No. 2 (1807). TYPE: Turkey, Constantinople (Istanbul): Halkali, Dwrekeny, 14 May 1905. G. V. Aznavaur s.n. (neotype here designated, G!).

Paeonia byzanthina DC., *Prodr.* 1: 66 (1824), pro syn. sub *P. decora*.

Paeonia officinalis auct. non L.: Retzius, *Bot. Mag.* 43: tab. 1784 (1816).

Perennials. Lateral roots fusiform or tuberous. Stems 30–70 cm tall, glabrous. Lower leaves biternate; petioles 20 cm long, petiolules 3.5–10 cm long; leaflets nearly all or all segmented, leaflets/leaf segments 17–45 in number, lanceolate, oblanceolate, or broad-linear, 3.5–11 cm long, 1.6–3.8 cm wide, always lobed, with 2–5 obtuse to acute lobes, often with bristles along veins above, slightly glaucous, glabrous or very occasionally sparsely pubescent beneath. Flowers solitary and terminal; involucre bracts usually 2 or 3, less frequently 1 or 4 in number, leaf-like; sepals 3–5 in number, green or green but purple at the periphery, mostly rounded at the apex, 2–3.5 cm long, 2–3 cm wide; corolla red or dark red, cup-shaped, petals 7–10 in number, obovate, entire or incised at the apex, 4–5 cm long, 2.5–3 cm wide; filaments yellow or red; disk c. 1 mm high, waved, white; carpels mostly 2 or 3, rarely 1 or 4 in number, tomentose, hairs c. 2.5 mm long; stigmas sessile, yellow, 1.8–3.3 mm wide. Follicles 3.5 cm long. Seeds ovoid-oblong, black, lucid, 8–10 mm long, 5–6 mm wide. Figs 5.28A, 5.28B.

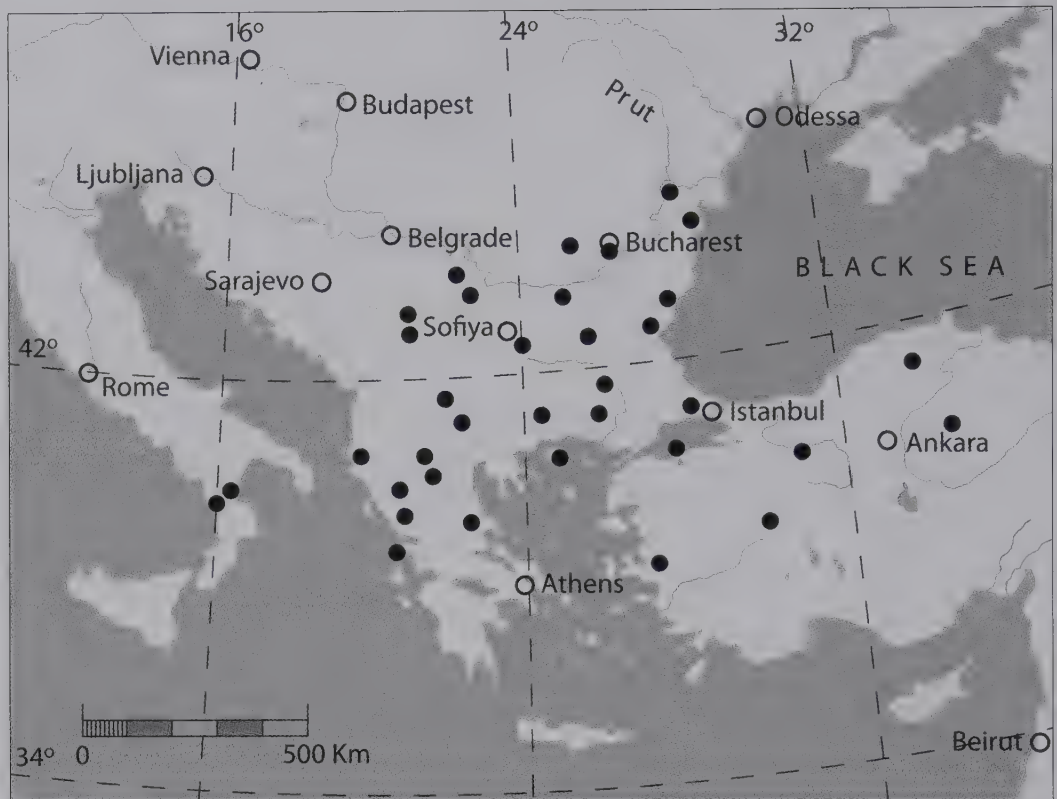
PHENOLOGY. Flowering from late May to June; fruiting in August.

CHROMOSOME NUMBER. $2n = 20$ (Dark, 1936; Langlet, 1927; Stern, 1944; Sushnik & Lovka, 1973; Tzanoudakis, 1977, 1983; Uspenskaya & Solovyeva, 1991; the present work with the voucher: Turkey, Ankara Prov., D. Y. Hong *et al.*, H02201 (A, BM, CAS, K, MO, PE)). However, Sopova (1971) reports both $2n = 10$ and $2n = 20$ from Macedonia.

HABITAT AND DISTRIBUTION. Growing mostly in deciduous broad-leaved forests, pine forests or mixed forests, less frequently in grasses. The species prefers calcareous soils and is found usually at altitudes from 50 to 1,500 m. Albania, Bulgaria, Greece, Italy (Mt San Donato di Ninea), Macedonia, Moldova (Uspenskaya & Solovyeva, 1991; Krupkina, 1996), Romania, Serbia and Turkey (Map 5.28).

DISTINGUISHING CHARACTERS. The most distinct character of *Paeonia peregrina* is its always teeth-lobed leaflets or segments, which distinguish it readily from *P. officinalis* and *P. saueri* D. Y. Hong, X. Q. Wang & D. M. Zhang. The other distinct characters are tuberous or fusiform lateral roots, leaflets or segments often with bristles along veins on the upper surface, and dark-red and cup-shaped corollas.

NOTES. The identity of *Paeonia peregrina* Mill. had been problematic for a century and a half since its description as new. Miller (1768) described this taxon rather clearly as “*foliis difformiter lobatis, lobis incis*”, “with a deep red flower” and “growing naturally in the Levant (ca. 15 km N of Istanbul)”. However, later authors failed to follow Miller's description. Sims (1807) followed the locality of *P. peregrina*, the Levant, but not the characters, and his “*P. peregrina*” is actually a new species, described as *P. arietina* by Anderson (1818). Anderson (1818) stated: “*P. peregrina*, de Candolle informs us, is a native of the mountains of Provence and Languedoc, chiefly near Montpellier.....” and he also cited “*Bot. Mag.* 1050”, which actually refers to *P. arietina*. Furthermore, he described the peony from Constantinople (Istanbul) as a new species, *P. decora* (Anderson, 1818). It is clear, therefore, that Anderson (1818) treated *P. officinalis* subsp. *huthii* from S France as *P. peregrina*, while describing the real *P. peregrina* as *P. decora*. Unfortunately, de Candolle (1818, 1824), Baker (1884), Lynch (1890), and Huth (1891) all followed Anderson (1818). It was Stapf (1918) who clarified the persisting confusion and correctly illustrated *P. peregrina* for the first time.



Map 5.28. Distribution of *Paeonia peregrina* Mill.

Paeonia tartarica Mill. (1768) was described by Stern (1946) as being “non satis nota”, and thus no taxonomical treatment was given by him or by succeeding authors. However, Miller’s description is clear, “The seeds.....from the Levant (N of Istanbul)”, “The roots.....oblong fleshy tubers or knobs leaves composed of several lobes, which are irregular in shape and size, some of them having but six, and others have eight or ten spear-shaped lobes.....”. This description fits *P. peregrina* Mill. well and better than any other species.

ADDITIONAL SPECIMENS EXAMINED. **ALBANIA**, Jouina Distr., above Musfriva, 13 June 1896, *A. Baldacci* s.n. (P). **BULGARIA**: Burgas, Mt Kara-tepe, at summit, 6 July 1893, *J. Wagner* 5 (BM, G, WU); Darsavlat Gora, Kala-Gvol, 13 June 1952, *L. Stoyalov & B. Kitalov* s.n. (SOM); Sliven, Mt Sini-Kamil, c. 1,000 m, 20 July 1907, *C. K. Schneider* 595 (BM, K, WU); Sredna Gora, 28 May 1964, *I. Ganzhev* s.n. (SOM); Sredna Gora, Fenara, in *Quercus* forests, 7 Apr. 1968, *M. Simeonovski* s.n. (SOM); Stanimaka, May 1892, *V. Stribrný* s.n. (WU); Stanimaka, to Kirike, June 1914, *V. Stribrný* s.n. (SOM); Stanimaka, 16 May 1896, *V. Stribrný* s.n. (G); *loc. eodem*, 4 July 1896, *V. Stribrný* s.n. (B); *loc. eodem*, June 1897, *V. Stribrný* s.n. (B, G); *loc. eodem*, May 1910, *V. Stribrný* s.n. (BM); *loc. eodem*, May 1916, *V. Stribrný* s.n. (E); Tedegspe, 1902, *Kol* s.n. (SOM); Turnovo, 1890, *Urumov* s.n. (WU); *loc. eodem*, 1896, *Urumov* s.n. (SOM); Varna, Mt Franka, 18 May 1907, *C. K. Schneider* 175 (BM, K, WU); Vriorica, Apr. 1890, *O. Reiser* s.n. (WU); Yambol, Bakaoleik, c. 450 m, 24 May 1931, *N. Stojanov* s.n. (SOM). **GREECE**: **Mt Athos**, Chilanolazi, *F. Guiol* s.n. (BM); **Ionian Islands**, Lefkas, Mt Stavrotas, N of Ajios Ilias, 900–1,150 m, limestones, 28 May 1971, *E. Stamatiadou* 12440 (ATH, BM, E); *loc. eodem*, NE of Hortata, 850–900 m, 20 Apr. 1977, *E. Stamatiadou* 19626 (ATH); *loc. eodem*, W of the Force Rader Station, 950 m, 14 May 1969, *P. Zambelis* 6189 (ATH); Lefkas, Mt Elati, above Karya, c. 900 m,

27 May 1974, *D. Tzanoudakis* 1402 (G, GZU, UPA); Ioannina Prov., Dodona, Kokkina Kladia, 500 m, 30 Apr. 1975, *D. Tzanoudakis* 2222 (GZU, UPA). **Jannina**, Muspina, 13 June 1896, *A. Baldacci* 53 (BM, WU). **Njausta**, Fetitza, 500 m, Apr. 1909, *Dimonie* s.n. (WU). **Paramythia**, Mt Murga, 6 July 1895, *A. Baldacci* 222 (BM). **Thasos**: Mt Ipsarion, above Sotir, 500 m, 27 May 1975, *D. Tzanoudakis* 2266 (GZU, UPA); Thasos, 500 m, Apr. 1909, *Dimonie*, s.n. (G, WU). **Thraki**, Evros Prov., Alexandroupolis, 260–300 m, *Quercus* forests, limestones, 19 May 1972, *E. Stamatiadou* 15209 (ATH). **Vodena**, Gramaticova, Apr. 1909, *Dimonie* s.n. (G). **ITALY**, Mt San Donato di Ninea, c. 1,200 m, 23 Aug. 1912, *C. C. Lacaita* 12-411 (BM). **MACEDONIA**: Krivolak, 30 May 1927, *P. Cernjavski* s.n. (BEO); Demir Kapija, 16 June 1925, *P. Cernjavski* s.n. (BEO). **ROMANIA**, **Comana**: *s. loc.*, 50 m, 20 May 1902, *G. Brândză* s.n. (P); *s. loc.*, 15 May 1932, *P. Cretzaiu* s.n. (G); Muntenia, 130 m, mixed forests, 14 May 1923, *G. P. Grintescu* s.n. (BUCA, G); Valea Gurbanului, 10 May 1883, *D. Grecescu* s.n. (WU); *loc. eodem*, May 1888, *D. Grecescu* s.n. (WU); Vlasca Distr., Mt Bravu, 8 May 1921, *G. P. Grintescu* s.n. (BM); Vlasca, 13 May 1901, *Z. C. Pantu* s.n. (G); *loc. eodem*, 18 May 1921, *G. P. Grintescu* s.n. (B, BM); Giurgiu, Mt Bravu, 80 m, in forests, 8 May 1921, *G. P. Grintescu* s.n. (BUCA). **Dobrukscha**: Caliacra Distr., June 1933, *P. Cretzaiu* & *J. Neuwirth* s.n. (BUCA); near Mihaileni, 1 July 1928, *T. Wisniewski* s.n. (K); Babadagh, 24 May 1873, *P. Sintensis* 515 (G); Babadagh, 1 July 1943, *T. Savulescu* s.n. (BUCA); Tulcea, Babagagh, Caugagia Valley, 12 May 1960, *G. Dihoru* s.n. (BUCA); *loc. eodem*, 2 May 1960, *G. Dihoru* s.n. (BUCA); *loc. eodem*, 17 June 1960, *G. Dihoru* s.n. (BUCA); *loc. eodem*, 20 June 1960, *G. Dihoru* s.n. (BUCA); *loc. eodem*, 9 May 1960, *G. Dihoru* & *N. Dorita* s.n. (BUCA); *loc. eodem*, in forests, 15 June 1936, *C. Zahariadi* s.n. (BUCA).



Fig. 5.28B. *Paeonia peregrina* Mill.: involucrate bracts and sepals, based on *D. Y. Hong*, *D. M. Zhang*, *X. Q. Wang* & *S. T. Koruklu* H02223 (A, CAS, K, MO, PE, UPA). The lower right, with the dark part green and light grey parts red when fresh, is between sepals and petals. Drawn by Mr SUN Yi-Bao.

Oltenia, Calafat, between Plenita and Verbiciora, 120 m, 20 May 1963, *Al. Buia, M. Paun, D. Cirtu et al.* s.n. (BM, BUCA, G, PE). **SERBIA**: Pirot, Belava, Mt Derlavis, c. 450 m, 11 May 1896, *L. Adamovic* s.n. (WU); *loc. eodem*, 500 m, 11 May 1896, *L. Adamovic* s.n. (B, WU); Pirot, Mt Belava, 20 May 1894, *L. Adamovic* s.n. (G); *loc. eodem*, 20 May 1903, *L. Adamovic* s.n. (G); *loc. eodem*, limestones, 20 May 1900, *L. Adamovic* s.n. (E); Pirot, Gujilem, May 1894, *L. Adamovic* s.n. (B); Nisch (Nis), 18 May 1898, *V. Moravac* s.n. (WU); Nisch, May 1884, *S. Petrovic* s.n. (G); Nisch, May 1886, *S. Petrovic* s.n. (WU). Zajecar, 3 May 1896, *L. Adamovic* s.n. (WU). **TURKEY**, **Ankara**, Nallihan, above Baglica Village, Gozelleme Observation Station, *Pinus nigra* forests, 1,255 m, 40°13'N, 31°19'E, 11 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu* H02201 (A, BM, CAS, K, MO, PE). **Balikesir**, Erdek, 300–400 m, 12 May 1965, *Kayacik & Yaltirik* 3269 (E). **Canstantinople (Istanbul)**: Halkali, Champs, 21 May 1907, *G. V. Aznavaur* s.n. (G); *s. loc.*, 23 May 1976, *H. J. Leep* 76–T50 (SA); Catalca, among shrubs, 18 May 1963, *H. Demiriz* 5056 (E). **Izmir**, Manisa Da , 1977, *H. J. Leep* 77–T 9 (SA). **Kastamonu**: Daday (15 km) to Eflani, 1,000–1,200 m, 30 July 1962, *Coode & Yaltirik* D38613 (E); Daday to Eflani, 20 km to Eflani, Selalmaz Village, 1,060 m, 22 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & S. T. Koruklu* H02223 (A, BM, CAS, K, MO, PE); Tosya, *Pinus nigra* forests, c. 1,300 m, 31 May 1976, *M. Kiling* 4067 (ANK); *loc. eodem*, c. 1,500 m, 12 June 1975, *M. Kiling* 3326 (ANK). **Kütahya**: 28 Apr. 1972, *H. J. Leep* 72–7 (SA). **Yozgat**: Sakarya Valley, Yarimca Cayir, June 1960, *Curtis* 193 (E). **Asia Minor**, Brousse, Mt Olympe, 6 June 1889, *B. Burnat* s.n. (G). Phrygie, Ouchak, 1 June 1857, *B. Balansa* s.n. (G).

- 29. *Paeonia saueri*** D. Y. Hong, X. Q. Wang & D. M. Zhang, *Taxon* 53(1): 88, figs 3 and 4 (2004). TYPE: Greece, Kavala Province, Mt Pangeon, above Eleftheroupolis, 40°55'N, 24°12'E, 960 m, at the edges of *Fagus sylvestris* forests with sparse *Juniperus* sp., limestones, 29 May 2002, *D. Y. Hong, D. M. Zhang & X. Q. Wang* H02227 (holotype PE!; isotypes A!, BM!, CAS!, K!, MO!, UPA!).

Perennials. Lateral roots tuberous, tubers fusiform. Stems 45–65 cm tall, green, rarely purple, glabrous. Lower leaves biternate, with some leaflets segmented, leaflets/leaf segments 19–45 in number, all entire or very few lobed, elliptic or narrow-elliptic, cuneate at the base, acute at the apex, 3.3–11 cm long, 1.0–4.2 cm wide, with bristles along veins above, sparsely hispidulous, very occasionally glabrous beneath. Flowers solitary and terminal; involucre bracts 2–3 in number, leaf-like; sepals 3–5, rarely 6 in number, glabrous, all rounded but sometimes one caudate at the apex, 2.5–3.0 cm long, 2.0–2.5 cm wide; petals 7–10 in number, red, obovate, cuneate at the base, rounded or variously incised at the apex, 5.0–5.5 cm long, 3.2–4.0 cm wide; filaments dark-purple; anthers yellow; disk fleshy, slightly waved or incised, c. 1 mm high; carpels mostly 2–3, less frequently 4, very rarely 1, 5 or 6 in number, whitish tomentose; stigmas sessile, red, about 2 mm wide; ovules 14–20 per carpel. Young follicles ovoid, 2.8–3.0 cm long, 1.9 cm in diameter. Figs 5.29A, 5.29B, 5.29C.

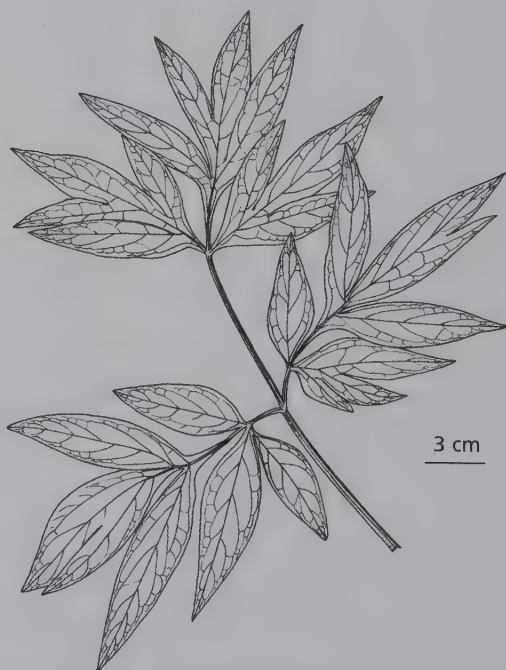


Fig. 5.29A. A lower leaf of *Paeonia saueri* (H02227 from Greece). Drawn by Mr SUN Yin-Bao.



Fig. 5.29B. *Paeonia sauri* D. Y. Hong, X. Q. Wang & D. M. Zhang: **a**, the upper part of the plant and a flower with petals and most of stamens shed, showing disk and carpels; **b**, fusiform roots; Drawn by Miss LI Ai-Li.

PHENOLOGY. Flowering in April and May.

CHROMOSOME NUMBER. $2n = 20$ (Hong *et al.*, 2004a).

HABITAT AND DISTRIBUTION. Growing usually near mountain summits, in deciduous forests, at the edges of forests or in clearings, on limestones or granites, at an altitude of 460–1,220 m. Found in NE Greece and S Albania (Map 5.29).

DIAGNOSTIC CHARACTERS. *Paeonia saueri* is characterised by tuberous roots (Figs 3.1e and 5.29A), lower leaves with 19–45 leaflets/leaf segments, and tetraploidy ($2n = 20$), which indicate its relatively close relationships with *P. peregrina*, *P. officinalis*, *P. arietina* and *P. parnassica*. Our cluster analysis and principal coordinate analysis showed that *P. saueri* is distinct from *P. peregrina*, *P. officinalis*, *P. arietina* and *P. parnassica* (Hong *et al.*, 2004a). It differs from the latter three in having glabrous stems, petioles and sepals, and in having leaves with bristles along veins on the upper surface and sparse hispidulous hairs on the lower surface. It differs from *P. peregrina* in having leaflets or segments that are entire, rarely lobed and sparsely hispidulous beneath, and in having red stigmas. *Paeonia officinalis* subsp. *banatica* was not taken into consideration when we described *P. saueri* as a new species. In

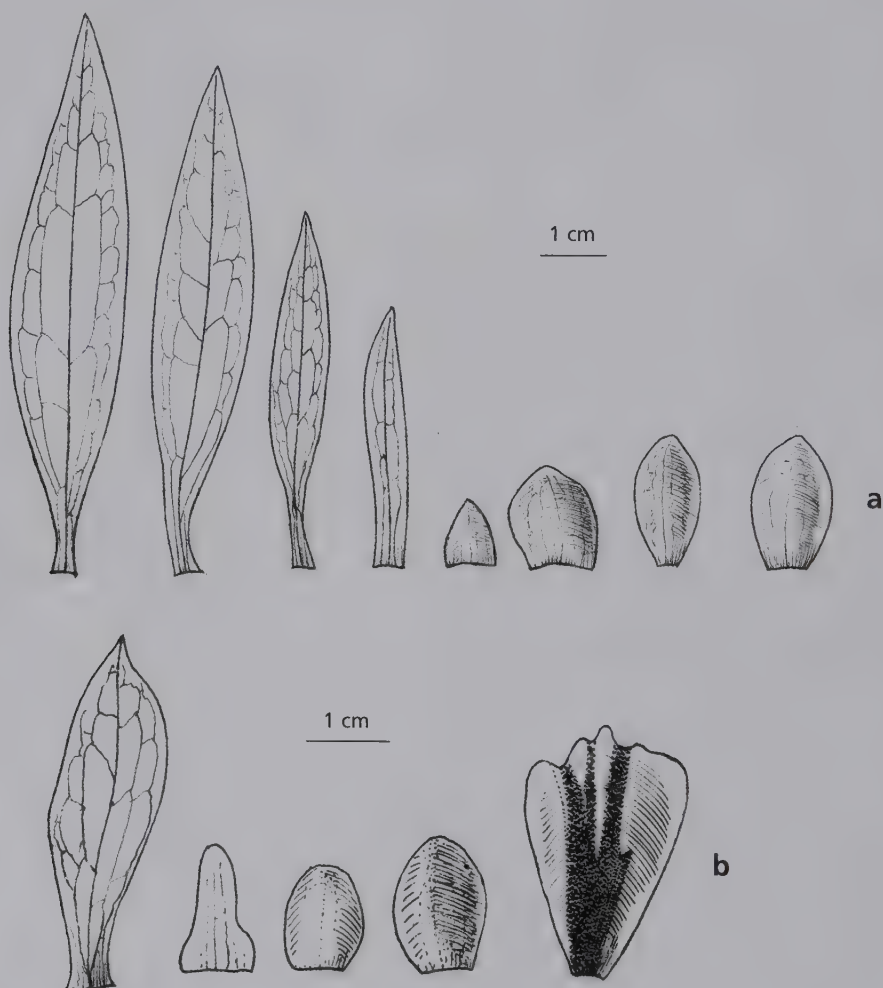


Fig. 5.29C. *Paeonia saueri* D. Y. Hong, X. Q. Wang & D. M. Zhang: involucrate bracts and sepals, drawn by Mr SUN Yi-Bao. **a** Based on D. Y. Hong, D. M. Zhang & X. Q. Wang H02227-5 (A, CAS, K, MO, PE, UPA). **b** Based on H02227-7; the image furthest to the right has the central and dark parts green but the lateral parts red when fresh and is between sepals and petals.

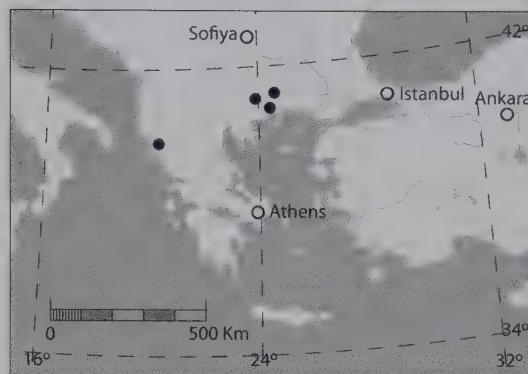
this subspecies, the leaves are glabrous above and sparsely villose or glabrous beneath, leaflets/leaf segments are fewer (11–24) than in the typical subspecies, and sepals are mostly hispidulous.

ADDITIONAL SPECIMENS EXAMINED.

ALBANIA, S ALBANIA, Melesine, above Leskovik, 1,220 m, near the summit, limestones, 19 June 1933, A. H. G. Alston & N. Y. Sandwith 1775 (BM, K). **GREECE:**

Makedonia: Kavala Province, Mt Pangeon, above Eleftheroupolis, 1,040 m, in *Fagus sylvestris* forests or clearings, limestones, 27 May 1985, G. & W. Sauer 31212 (PE, SA); *loc. eodem*, *Fagus–Quercus–Carpinus–Fraxinus*

mixed forests, clearings with *Pteridium aquilinum*, c. 910 m, limestones, 27 May 1985, G. & W. Sauer 31198 (PE, SA); *loc. eodem*, 30 Apr. 1961, K. H. Rechinger 22478 (GZU); Mt Pangeon, W of Palaiochiori or Akrovounion, *Betula sylvestica* forests, granites and Mediterranean brown loess, 900 m, 23 Mar. 1979, G. & W. Sauer 24108 (PE, SA); Mt Pangeon, 30 km W of Kavala, 460 m, irrigated grass meadows, 24 May 1959, Stainton 7536 (K).



Map 5.29. Distribution of *Paeonia saueri* D. Y. Hong, X. Q. Wang & D. M. Zhang.

30. *Paeonia arietina* G. Anderson, *Trans. Linn. Soc. London* 12: 275 (1818), pro parte, excl. *B. Oxoniensis*; de Candolle, *Prodr.* 1: 66 (1824), pro parte, excl. *B. carnea*; Lynch, *J. Roy. Hort. Soc.* 12: 440 (1890), pro parte, excl. var. *cretica*; Huth, *Bot. Jahrb. Syst.* 14(3): 270 (1891) (pro syn. sub *P. peregrina* Mill.); Stern, *J. Roy. Hort. Soc.* 68: 127 (1943); Stern, *Study Gen. Paeonia*, 81 (1946), pro parte, excl. specim. Graec.; Hong, Zhang, Wang, Koruklu & Tzanoudakis, *Taxon* 57(3): 928 (2008). *Paeonia mascula* (L.) Mill. subsp. *arietina* (G. Anderson) Cullen & Heywood, *Feddes Repert.* 69: 35 (1964), pro parte, excl. pl. “Crete” and “W. Russia”; Davis & Cullen in Davis, *Fl. Turkey* 1: 205 (1965); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 294 (1993); Halda, *Gen. Paeonia*, 69 (2004). TYPE: Turkey, Prov. Balikesir, Mt Ida (Kaz Dağı), near Kareikos, in forests, 22 June 1883, P. Sintenis 459 (neotype designated by Hong *et al.* 2008: 928 K!; isoneotypes BM!, G!).

Paeonia arietina G. Anderson var. *andersonii* G. Anderson, *Trans. Linn. Soc. London* 12(1): 275 (1818).

Paeonia bakeri Lynch, *J. Roy. Hort. Soc.* 12: 441 (1890). TYPE: Lynch’s figure cited (lectotype here designated!).

Paeonia cretica Sabine ex Lindl., *Bot. Reg.* 10: tab. 819 (1824). TYPE: Lindley’s tab. cited (holotype!).

Paeonia pallens Sims ex Boiss., *Fl. orient.* 1: 97 (1867), (pro *P. pullens*; pro syn. sub *P. peregrina* Mill.).

Paeonia peregrina auct. non Mill.: Sims, *Bot. Mag.*, 26: tab. 1050 (1807), pro parte excl. syn.; Boissier, *Fl. orient.* 1: 97 (1867), pro parte, excl. var.

Perennials. Tap roots columnar, lateral roots always tuberous, sometimes tubers beaded. Stems 30–70 cm tall, green, usually entirely hirsute, rarely hirsute only above, with 4–7, rarely up to 15, yellowish green or purplish scales at the base. Lower leaves biternate; leaflets decurrent, usually with some segmented or shallowly divided; leaflets/leaf segments most frequently 13–23, rarely down to 11 and up to 32 in number; petioles and petiolules densely hirsute; blades elliptic, oblong or ovate-lanceolate, cuneate at the base, acute at the apex, 5–12 cm long, 3–6 cm wide, glabrous or villose along major veins above, but mostly densely, very rarely sparsely villose beneath. Flowers solitary and terminal; involucre bracts 1–3 in number, leaf-like; sepals 3–5 in number, unequal in size, all rounded at the apex, villose outside, green but purple at the periphery; petals 6–9 in number, rose or red, obovate, entire or rarely deeply lobed; filaments purple, anthers yellow; disk waved, glabrous but sometimes hirsute; carpels 2 or 3, less frequently 4 or 5, occasionally 1 in number, yellow tomentose, hairs 2.5 mm long; styles very short or absent; stigmas red, c. 1 mm wide. Follicles 2–3 cm long. Figs 5.30A, 5.30B.



Fig. 5.30A. *Paeonia arietina* G. Anderson: a, the lower part of the plant, showing roots and caudex; b, a lower leaf; c, a flower; d, a flower with petals and stamens shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.

PHENOLOGY. Flowering in May and June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 20$ (Barber, 1941; Stern, 1944; the present work with the voucher: Turkey, Sivas, H02216).

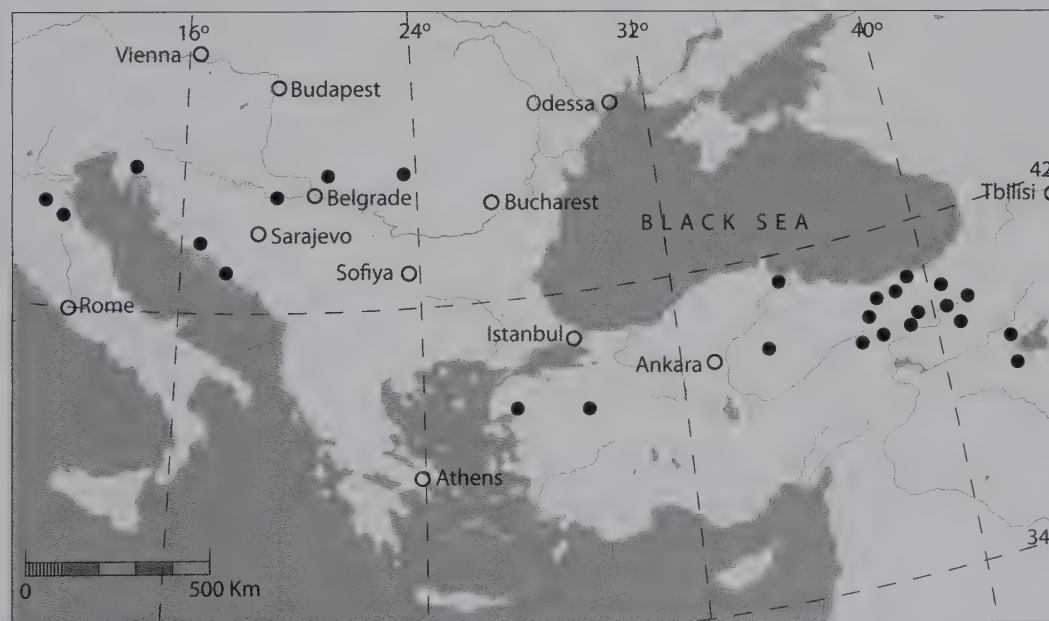
HABITAT AND DISTRIBUTION. Growing usually in sparse oak or coniferous woods, or in clearings of forests, also in pastures, on limestones but also granites, with a wide range of altitudes from 300 m in Emilia of Italy to 2,100 m in Kutahya Province of Turkey. Distributed in Turkey, Romania, Bosnia-Herzegovina, Albania, Croatia and Italy (Emilia) from the east to the west (Map 5.30).

NOTES. Although Sabine's (1824) taxon has epithet "*cretica*", his plant was not from Crete. Stern (1940) provides a clear explanation.

The taxonomic treatment of *Paeonia arietina* G. Anderson (= *P. mascula* subsp. *arietina* (G. Anderson) Cullen & Heywood) has been controversial. *Paeonia arietina* was described first by Anderson (1818: 275), who clearly indicated that his new species was characterised by tuberous roots, pilose stems and petioles, leaflets that are decurrent and glaucous-pilose beneath, and sepals that are pilose at the base. Two varieties were recognised by Anderson in this species: var. *andersonii* and var. *oxoniensis*. He described the first from a garden in England and presumed it to be a native of the Levant (near Istanbul, Turkey), and the second from the Oxford Botanic Garden, wrongly considering it a native of Crete following Mr Clusius (Stern, 1940). De Candolle (1824) recognised *P. arietina* and considered it to be from "Oriente". Lynch (1890) completely followed Anderson, enumerating the two varieties and considering them originally from the Levant and Crete, respectively.

Stern (1946) not only recognised *Paeonia arietina* but also was the first author to indicate its distribution by quoting herbarium specimens. The specimens cited by Stern mostly match Anderson's protologue very well, e.g. those from Turkey (Anatolia and Armenia), Bosnia and Italy (Emilia).

Cullen and Heywood (1964a, 1964b) reduced *Paeonia arietina* G. Anderson to *P. mascula* subsp. *arietina* (G. Anderson) Cullen & Heywood. They ignored Stern's (1940) article, and thus continued to include Crete in the distribution range of this entity. Their treatment was followed by Davis and Cullen (1965b), Akeroyd (1993), and Halda (2004). Which treatment is natural? That is to say, is *P.*



Map 5.30. Distribution of *Paeonia arietina* G. Anderson.

arietina an independent species or just a subspecies within *P. mascula*? In the molecular phylogenies of *Paeonia* sect. *Paeonia* produced by Sang and his co-workers (Sang *et al.*, 1995, 1997a), *P. arietina*, *P. parnassica* and *P. officinalis* (including *P. humilis*, = *P. officinalis* subsp. *microcarpa*) could not be distinguished from each other on the *matK* and *psbA-trnH* trees. Nevertheless, these three species are differentiated clearly from *P. mascula* subsp. *mascula* and *P. mascula* subsp. *hellenica* on all of these trees (Sang *et al.*, 1997a). On the basis of ITS sequences for sect. *Paeonia*, *P. arietina*, *P. parnassica* and *P. officinalis* (including *P. humilis*) form a group, within which they are indistinguishable from each other, whereas *P. mascula* subsp. *mascula* and subsp. *hellenica* form another group with *P. coriacea*, *P. broteri*, *P. clusii* (including *P. rhodia*), *P. mlokosewitschii* (= *P. daurica* subsp. *mlokosewitschii*), etc. (Sang *et al.*, 1995). The phylogeny of sect. *Paeonia* reconstructed from a synthesis of the ITS and *matK* phylogenies indicates that *P. arietina*, *P. parnassica* and *P. officinalis* (including *P. humilis*) form a group, which is divergent from another group comprising *P. mascula* (including two subspecies, subsp. *mascula* and subsp. *hellenica*), *P. coriacea*, *P. clusii* (including *P. rhodia*) and *P. mlokosewitschii* (Sang *et al.*, 1997a). Therefore, molecular phylogeny shows that the *P. arietina*–*P. parnassica* group is more closely related to *P. officinalis* than to *P. mascula*. Our *Adh1* and *Adh2* gene trees also demonstrate that the *P. arietina*–*P. parnassica* group forms a clade that is separated from the *P. mascula* clade (Pan *et al.*, unpublished).

According to our observations, there are distinct differences between the *Paeonia mascula* group on one side and the *P. arietina*–*P. parnassica* group together with the *P. officinalis* group on the other. In the *P. mascula* group, the roots are always carrot-shaped, whereas they are tuberous, sometimes even tandem-tuberous, in all populations observed in the *P. arietina*–*P. parnassica* and *P. officinalis* groups (Figs 5.30A and 5.21A). Root shape, whether tuberous or carrot-shaped, has been ignored by nearly all previous authors working on the genus *Paeonia*, but is a very stable character and thus of great significance in taxonomy (Hong *et al.*, 1994, 2008). All the individuals observed in the *P. arietina*–*P. parnassica* group have hirsute stems, petioles and sepals, whereas these parts are always glabrous in the *P. mascula* group. These two groups also differ in the indumentum on the lower surface of leaves. Leaves are mostly glabrous, less frequently sparsely hispid beneath in the *P. mascula* group, but mostly rather densely, very rarely sparsely, villose beneath in the *P. arietina*–*P. parnassica* and *P. officinalis* groups. There are further differences in the shape and size of leaflets/leaf segments. Those in the *P. mascula* group are obovate, broad-ovate or broad-elliptic, 6–15 cm long, 4–9 cm wide, whereas those in the other two groups are elliptic, ovate-lanceolate or oblong, 5–12 cm long, 1.5–6 cm wide. Therefore, the closest relative of *P. arietina*–*P. parnassica* is the *P. officinalis* group, not *P. mascula* as in the treatments of Cullen and Heywood (1964a, 1964b), Akeroyd (1993), Davis and Cullen (1965b), and Halda (2004).

Paeonia arietina, *P. parnassica*, *P. officinalis* and *P. banatica* are similar to each other in morphology. They share a number of characters: roots tuberous, leaflets mostly segmented, stems, petioles, lower leaf surfaces and sepals nearly always hairy, and chromosome number $2n = 20$ (tetraploid). According to

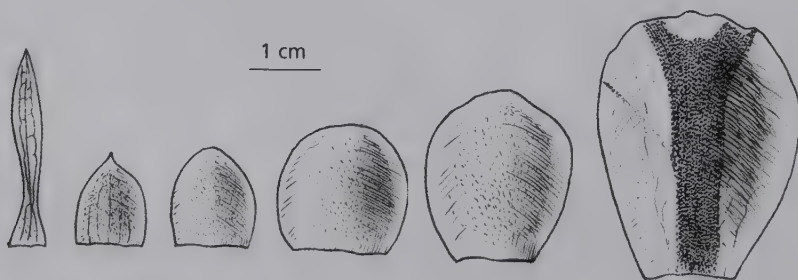


Fig. 5.30B. *Paeonia arietina* G. Anderson: involucre bracts and sepals, based on D. Y. Hong, D. M. Zhang & X. Q. Wang H02204 (A, CAS, K, MO, PE, UPA). The image furthest to the right, which has the central and dark part green and lateral parts red when fresh, is between sepals and petals. Drawn by Mr SUN Yin-Bao.

our observations, *P. arietina* and *P. parnassica* are more similar to each other than to the *P. officinalis*-*P. banatica* group. Generally in the *P. arietina*-*P. parnassica* group, stems and petioles are always rather densely hirsute, and leaflets/leaf segments are oblong, ovate-lanceolate, or rarely elliptic. By contrast, in the *P. officinalis*-*P. banatica* group, stems and petioles are sparsely hirsute or glabrous, and leaflets/leaf segments are ovate-lanceolate, elliptic or linear-elliptic. The most distinct difference between these two groups is perhaps in the indumentum on the abaxial side of the sepals, which is densely villose in the *P. arietina*-*P. parnassica* group but densely to sparsely hispidulous or even glabrous in the other group. Within the *P. arietina*-*P. parnassica* group, *P. arietina* has a greater number of leaflets or segments, rose to red petals, and yellow anthers, whereas *P. parnassica* has dark purple petals and purple anthers.

ADDITIONAL SPECIMENS EXAMINED. **ALBANIA**, Boden, alpine region, 6 July 1914, *Reise* 511 (WU). **BOSNIA-HERZEGOVINA**, Rogatica, Rudinica, Rusanovic, 970 m, May 1897, *F. Fiala* s.n. (B, G, GZU). Near Sivolje, 1,200 m, May 1912, *Bucalovic* s.n. (BM). Mt Jamnica, near Vardiste, 800–900 m, 3 May 1911, *K. Maly* s.n. (WU). **CROATIA**, **Velebit Mts**: between Obrovac and Gračac, 750–900 m, 15 June 1973, *J. Poelt* s.n. (GZU); Karlobag, 700–800 m, 2 June 1963, *H. Tepner* s.n. (GZU); S of Karlobag, 1,100 m, 7 June 1987, *H. Melzer* s.n. (GZU); *loc. eodem*, 8 June 1987, *H. Melzer* s.n. (GZU); SW of Glavica, c. 850 m, 15 June 1973, *Moschl & Pittoni* s.n. (GZU). **ITALY**, **EMILIA**, **Bologna Prov.**, near Sasso, 300 m, 29 Apr. 1904, *A. Fiori* s.n. (BM, K); *loc. eodem*, 300 m, granites, 30 May 1910, *A. Fiori* s.n. (BM, K). **Modena Prov.**, *A. Mori* s.n. (K). **ROMANIA**, **Temes**, Flaminda, 7 July 1897, *H. Laszlo* s.n. (BP). **Transylvania**, in forests, *Oppolzer* s.n. (WU). **TURKEY**, **Amasya**: Merzifon, June 1900, *Manisadjian* s.n. (G); Akdag, above Zefe Köy, near limestone cliff, 1,800 m, 26 June 1965, *C. Tobey* 1230 (E). **Balikesir**: Mt Ida (Kaz Dağı), between Ayazma and Kobakli, 39°45'N, 26°52'E, NE slopes, 1,000 m, limestones, in (or at edges of) *Pinus nigra* forests 13 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & T. Koruklu* H02204 (A, CAS, K, MO, PE, UPA); Mt Ida, damp woods of *Pinus nigra*, 600–800 m, 19 May 1962, *Dudley* D34799 (E). **Bayburt**: Strasse, 18 May 1972, *H. J. Leep* s.n. (SA); between Bayburt and Gümüşhane, around Vaukağı Pass, 1,860 m, 13 Sep. 1993, *M. Pitman & A. Wickham Turx* 250 (K). **Bingöl**: 30 km W of Bingöl, *Quercus* scrubs, 1 Sep. 1954, *Polunin & Davis* 24809 (E, K); Elazığ, 1 Sep. 1954, *Davis & Polunin* 24808 (K). **Bitlis**: Karz Dag, above Kotum, limestones, rocky slopes, 1,830–2,000 m, 28 June 1954, *Davis* 22240 (BM, E, K); Karz Dag, 2,000 m, 23 Aug. 1954, *Polunin & Davis* 24556 (E, K); near Sicak Su, Nemrut Dag, S slopes, c. 1,800 m, oak scrub, 20 May 1966, *Davis* 44322 (E, K); Tatvan, 12 May 1970, *H. J. Leep* s.n. (SA); *loc. eodem*, 14 May 1972, *H. J. Leep* 7241 (SA); *s. loc.*, 2,000–2,130 m, 27 July 1966, *Tong* 114 (E). **Erzincan**, Mercan Dagllari, Munzur Silsilesi, Tayran Dag, N slopes, 750–2,000 m, 15 July 1967, *Albury, Cheese & Watson* 3309 (K). **Erzurum**: Kopda lari Gecidi, 18 May 1972, *H. J. Leep* 72–46 (SA); Aflkale, 29 May 1972, *H. J. Leep* 72–57 (SA); near Erzurum, 39°55'N, 41°20'E, 1853, *Pavillon* 630 (G); Hinis, July 1976, *J. G. E. Bowen* s.n. (K). **Giresun**, 14 km to Alucra from Sebinkarahisar, 40°20'N, 38°38'E, 1,350 m, S stony slopes, in sparse *Quercus* woods, 19 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & T. Koruklu* H02218 (PE, UPA). **Gümüşhane**: *s. loc.*, 1,300 m, 4 May 1960, *Stainton* 8328 (E); *s. loc.*, 1,200 m, 18 July 1934, *E. K. Balls & W. B. Gourelag* 1723 (K); Soğanlı Dağ, N of Bayburt, 1,700 m, 1957, *Davis & Hedge* D31990 (BM, E); 20 km SE of Gümüşhane, 1,200 m, 4 June 1973, *Grey-Wilson & Philips* 36 (K); Torul, Kalkanli, 40°36'N, 39°24'E, NW slopes, 1,820 m, clearings of *Pinus sylvestris* forests, 20 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & T. Koruklu* H02220 (PE); above Talsaban, 26 May 1894 and 7 July 1894, *P. sintenis* 5591 (E, G, K, W); Fstavros, 9 Aug. 1889, *P. sintenis* 1780 (G, K); Mt Choutoura, 16 May 1862, *E. Bourgeau*, s.n. (BEO, BGUB, E, P). **Kutahya**, Simav, Kicir to Akdaz, near summit, 2,100 m, 19 June 1965, *M. J. E. Coode & B. M. G. Jones* 2732 (E). **Sivas**: Zara (Sara), 10 km from Zara to Serefiye, 39°57'N, 37°44'E, 1,700 m, pastures with scattered *Juniperus*, *Rosa*, *Berberis*, etc., 19 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & T. Koruklu* H02216 (A, CAS, K, MO, PE, UPA); Zara, 1,450 m, 30 May 1972, *H. J. Leep*, s.n. (SA); Zara, 22 May 1972, *H. J. Leep* 70–72 (SA); Zara, 25 km from Zara to Süflehri, 39°58'N, 37°58'E, 1,850 m, N slopes, sparse *Quercus* woods, 19 May 2002, *D. Y. Hong, D. M. Zhang, X. Q. Wang & T. Koruklu* H02217 (A, K, MO, PE). **Trabzon**, *s. loc.*, 1,520 m, 3 July



Fig. 5.31A. *Paeonia parnassica* Tzanoud.: a, a root; b, the lower part of the stem and caudex; c, a lower leaf; d, the upper part of the stem; e, a flower with petals and stamens shed, showing disk and carpels. Drawn by Miss CAI Shu-Qin.

1960, *Furse & Synge* 805 (K). **Tunceli:** Munzur Dağ, above Ovacik, 1,700 m, by stream, 21 July 1957, *Davis & Hedge* D31467 (BM, E, K); Hozat–Ovacik, 2,000 m, *Quercus* woods, 14 July 1957, *Davis & Hedge* D31105 (BM, E); between Pülümür & Selepur, 1,900 m, oak and willow thickets, 8 June 1957, *Davis & Hedge* D29299 (BM, E); between Pülümür and Kirmizi Köprü, to Mezra Koy, 1,400 m, 21 May 1981, *S. Yildirimli* 4379 (G). **Yozgat,** June 1960, *Curtis* 116 (E).

31. *Paeonia parnassica* Tzanoud., *Cytotax. Study Paeonia in Greece*, 43 (1977); Stearn & Davis, *Peonies Greece*, 71, pl. 4, fig. 26 (1984); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 293 (1993); Phitos in Strid & Kit Tan, *Fl. Hellenica* 2: 77 (2002). TYPE: Greece, Phokis Prov., Mt Parnassos, above Agoriani, c. 1,100 m, in *Abies* forests, 29 May 1974, *D. Tzanoudakis* 1400 (holotype UPA!; isotypes BM!, E!).

Paeonia peregrina var. *latifolia* Boiss., *Fl. orient.* 1: 98 (1867). TYPE: Greece, Mt Parnassos, 1,500 m, 28 June 1854, *T. G. Orphanides* 445 (holotype K!; isotypes G!, WU!).

Perennial herbs. Tap roots columnar; lateral roots tuberous or fusiform, sometimes tandem-fusiform. Stems usually green or green but pale purple in the lower part, sparsely to densely hirsute, 30–70 cm tall, with 4–9 green or greenish yellow scales at the base. Petioles and petiolules always hirsute; lower leaves biternate, with 9, rarely 8, leaflets, usually one or several leaflets segmented and thus leaflets/leaf segments 9–15, very rarely up to 25 in number, ovate, oblong or elliptic, cuneate to rounded at the base, nearly rounded to acute at the apex, 4.5–12 cm long, 1.5–7 cm wide, glabrous above, mostly densely, less frequently sparsely, villose beneath. Flowers solitary and terminal; involucre bracts 1–3 in number, leaf-like; sepals 3–4 in number, with one caudate and the rest rounded at the apex, nearly orbicular, 2–4 cm long, 1.5–3.5 cm wide, green but purple at the periphery or entirely purple, densely villose on the abaxial side; petals 6–8 in number, dark purple, oblong or obovate, entire or 2-lobed at the apex, 4.5–6 cm long, 3–4.5 cm wide; filaments purple; anthers purple; disk 1–1.5 mm high, waved, tomentose; carpels 1–3, but mostly 2 in number, columnar-ellipsoid, 1.4–2.2 cm long, 0.5–0.7 cm in diameter, yellowish tomentose, hairs 2 mm long; stigmas sessile, red, c. 2 mm wide. Figs 5.31A, 5.31B.

PHENOLOGY. Flowering in late May and early June.

CHROMOSOME NUMBER. $2n = 20$ (Tzanoudakis, 1977, 1983; the present work with the voucher: Greece, Mt Parnassos, *D. Y. Hong et al.* H02224 (A, BM, CAS, K, MO, PE)).

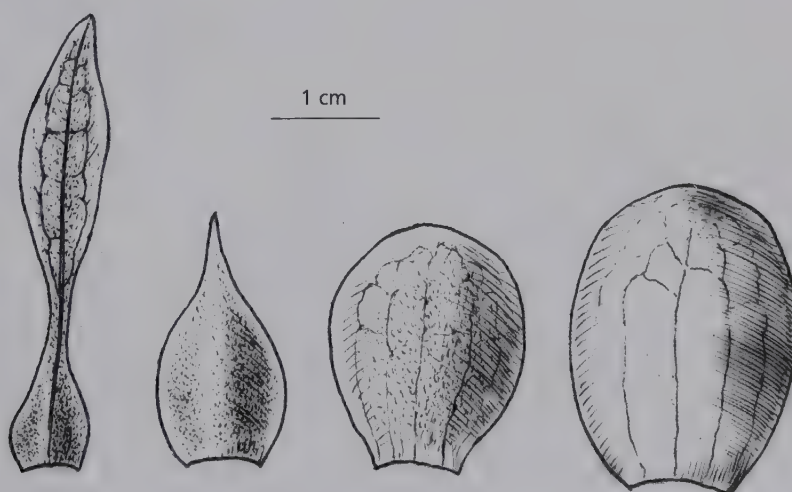


Fig. 5.31B. *Paeonia parnassica* Tzanoud.: involucre bracts and sepals, based on *D. Y. Hong, D. M. Zhang, X. Q. Wang & D. Tzanoudakis* H02224 (A, BM, CAS, K, MO, PE). Drawn by Mr SUN Yin-Bao.

HABITAT AND DISTRIBUTION. Growing at the edges and in openings of *Abies* forests, or in sparse *Abies* forests, on limestones, at an altitude of 1,100–1,500 m. Found only in the mountains Parnassos and Elikonas (Helicon) of Greece (Map 5.31).

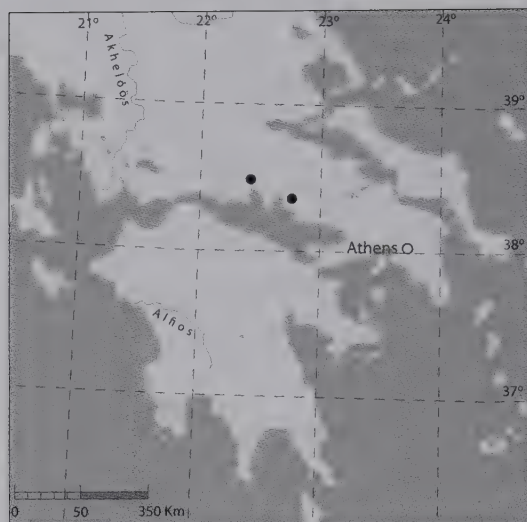
DIAGNOSTIC CHARACTERS. The most remarkable characters of *Paeonia parnassica* are its very dark purple petals and purple anthers, which distinguish it from *P. arietina*. It has fewer leaflets/leaf segments (9–15, rarely up to 25) than *P. arietina* (11–25, rarely up to 32).

ADDITIONAL SPECIMENS EXAMINED.

GREECE, PROV. PHOKIS, Mt Parnassos:

16–17 km SE of Eptalofos, 1,200–1,300 m, 23 May 1982, *E. Stamatiadou* 22045 (BM); *loc. eodem*, 38°35'N, 22°31'E, 1,210–1,250 m, 25 May 2002, *D. Y. Hong*, *D. M. Zhang*, *X. Q. Wang* & *D. Tzanoudakis* H02224 (A, BM, CAS, K, MO, PE);

Madia, July 1855, *J. Guiciardi* s.n. (WU); near Carcaria, 1,500 m, 10 July 1854, *T. G. Orphanides* 449 (BM, G, K, WU); 1,500 m, 20 July 1854, *T. G. Orphanides* s.n. (BM); N Arachova, 1,200 m, 30 Apr. 1976, *H. Malicky* s.n. (BM, W). **Mt Elikonas (Helicon):** 1,200 m, in *Abies* forests, May 1934, *S. C. Atchley* 2000a (K); *loc. eodem*, June 1934, *S. C. Atchley* 2000b (K).



Map 5.31. Distribution of *Paeonia parnassica* Tzanoud.

32. *Paeonia officinalis* L., *Sp. pl.* 530 (1753); Retzius, *Observ. bot.* 3: 35 (1783); Willdenow, *Sp. pl.* 2(2): 1221 (1799), pro parte, excl. pl. Ida.; Martyn in Miller & Martyn, *Gard. dict.* edn 9, 2(1): No. 2 (1807), pro parte, quoad var. *feminea*; de Candolle, *Syst. nat.*, 389 (1818), pro parte, excl. pl. Cret., Graec. & Georg.; de Candolle, *Prodr.* 1: 65 (1824), pro parte, excl. “Bot. Mag. tab. 1784”; Anderson, *Trans. Linn. Soc. London* 12(1): 264 (1818), pro parte, excl. pl. Graec. & Caucas.; Lynch, *J. Roy. Hort. Soc.* 12: 437 (1890), pro parte, excl. var. *lobata*; Stern, *Study Gen. Paeonia*, 99 (1946); Cullen & Heywood, *Feddes Repert.* 69: 34 (1964); Cullen & Heywood in Tutin *et al.*, *Fl. Europ.* 1: 243 (1964); Akeroyd in Tutin *et al.*, *Fl. Europ.* edn 2, 1: 293 (1993). TYPE: N° 692.1 (lectotype designated by Schmitt, 2003: LINN!)

Paeonia sessiliflora Sims, *Bot. Mag.* 53: tab. 2648 (1826). TYPE: Sims’ tab. cited (holotype!).

Paeonia promiscua Tausch, *Flora* 11: 83 (1828); Reichenbach, *Icon. fl. germ. helv.* 4: 28, tab. 4742 (1840). TYPE: Reichenbach’s tab. cited (neotype here designated!).

Paeonia pubens Sims, *Bot. Mag.* 48: tab. 2264 (1821); Lynch, *J. Roy. Hort. Soc.* 12: 442 (1890). TYPE: Sims’ tab. cited (holotype!).

Paeonia porrigens Rchb., *Fl. germ. excurs.* 2: 752 (1832) and *Icon. fl. germ. helv.* 4: 28, tab. 4744 (1840). TYPE: Reichenbach’s tab. cited (neotype here designated!).

Paeonia barrii Lynch, *J. Roy. Hort. Soc.* 12: 442 (1890). TYPE: W. J. Hooker’s tab.: *Bot. Mag.* 62: tab. 3431 (1835), cited by Lynch (holotype!).

Paeonia baxteri Sabine ex Salm-Dyck, *Hort. Dyck*, 370 (1834), pro syn. sub *P. peregrina*.

Paeonia lanceolata Salm-Dyck, *Hort. Dyck*, 367 (1834). TYPE: not designated.

Paeonia elegans Sabine ex Salm-Dyck, *Hort. Dyck*, 370 (1834). pro syn. sub *P. officinalis*.

Paeonia foemina Garsault, *Fig. Pl. méd.* 2: 260. pl. 435B (1764), syn. nov. TYPE: Garsault’s pl. cited (holotype!).

Paeonia foeminea Mill., *Gard. dict.* edn 8.2 (1768), syn. nov. TYPE: not designated.

Paeonia subternata Salm-Dyck, *Hort. Dyck*, 367 (1834). TYPE: not designated.

Paeonia officinalis L. var. *feminea* L., *Sp. pl.*, 530 (1753). *Paeonia feminea* (L.) Desf., *Tabl. école bot.*, 126 (1804); Gürke in Richter (ed.), *Fl. eur.* 2: 402 (1903), pro parte, excl. var. *cretica*. *Paeonia officinalis* L. subsp. *euofficinalis* var. *feminea* (L.) Fiori in Fiori & Paoletti, *Fl. Italia* 1(2): 526 (1898). TYPE: “*Paeonia feminea altera* C. B. p.”, n° 211. 1. C (lectotype designated by Schmitt, 2003: Clifford Herbarium, BM!); Epitype: “in pascuis M. Generosi”, vol. 30, No 122 (down) (designated by Schmitt, 2003: Haller Herbarium, P).

Paeonia hirsuta Mill., *Gard. dict.* edn 8, No 4 (1768). *Paeonia officinalis* L. var. *hirsuta* (Mill.) Martyn in Miller & Martyn, *Gard. dict.* edn 9, 2 (1807). TYPE: not designated.

Paeonia festiva Tausch in *Flora* 11: 84 (1828). TYPE: not designated.

Paeonia paradoxa G. Anderson in *Trans. Linn. Soc. London* 12: 280 (1818). *Paeonia officinalis* L. subsp. *euofficinalis* Fiori var. *paradoxa* (G. Anderson) Fiori in Fiori & Paoletti, *Fl. Italia* 1(2): 527 (1898). *Paeonia peregrina* Mill. f. *paradoxa* (G. Anderson) Rouy & Foucaud, *Fl. France* 1: 145 (1893). TYPE: not designated.

Paeonia paradoxa G. Anderson var. *fimbriata* Sabine in *Trans. Hort. Soc. London* 2: 276 (1817). TYPE: not designated.

Paeonia mollis G. Anderson, *Trans. Linn. Soc. London* 12(1): 282 (1818), and *Bot. Reg.*, tab. 474 (1820); de Candolle, *Prodr.* 1: 66 (1824); Baker, *Gard. Chron.* n. ser. 21: 829 (1884); Stern, *J. Roy. Hort. Soc.* 68: 130 (1943) and *Study Gen. Paeonia*, 108 (1946). TYPE: Anderson's tab. cited (neotype here designated!).

Paeonia commutata Wender., *Flora* 12(1): 29 (1829). TYPE: not designated.

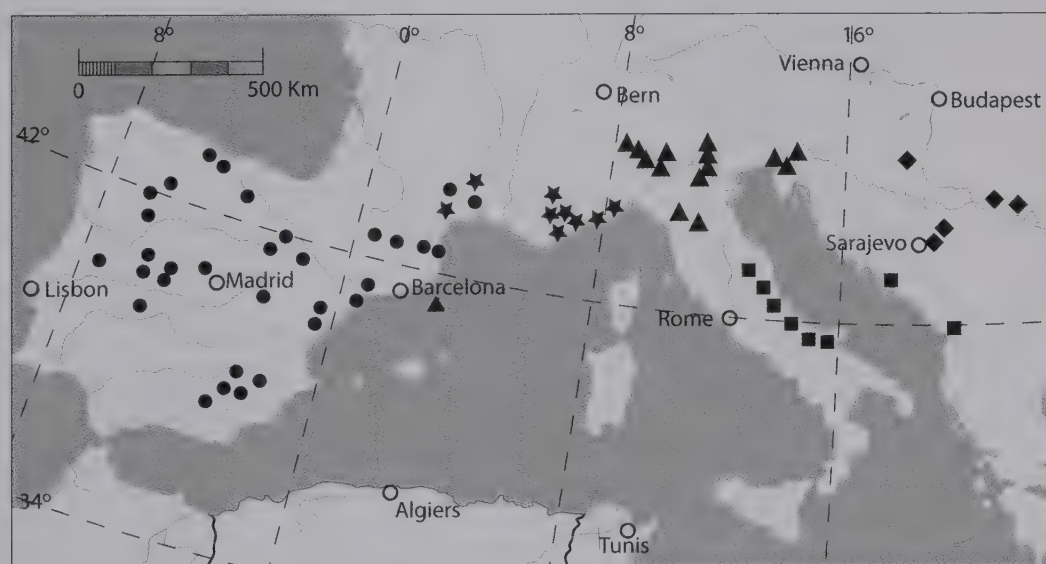
Paeonia rosea auct. non J. St.-Hil.: Host, *Fl. austriac.* 2: 64 (1831).

Paeonia lobata auct. non Desf. ex DC.: Reichenbach, *Icon. fl. germ. helv.* 4: 28, tab. 474 la (1840).

Paeonia nemoralis Salisb., *Prodr.*, 375 (1796), nom. illeg.

Paeonia peregrina auct. non Mill.: Anderson, *Trans. Linn. Soc. London* 12: 277 (1818), pro parte, excl. var. *byzantina*; Huth, *Bot. Jahrb. Syst.* 14: 270 (1891), pro parte, excl. var. *cretica*.

Paeonia villosa sensu Sweet, *Hort. brit.*, 10 (1827), non Desf. (1804).



Map 5.32. Distribution of *Paeonia officinalis* L.: black circles = subsp. *microcarpa* (Boiss. & Reut.) Nym.; stars = subsp. *huthii* Soldano; triangles = subsp. *officinalis*; squares = subsp. *italica* Bernardo & Passalacqua; diamonds = subsp. *banatica* (Rochel) Soó.

Perennials. Roots tuberous-thickened. Caudex short, less than 10 cm long. Stems mostly hirsute, green or purple-red, 25–80 cm tall. Lower leaves biternate, with 9 leaflets; petioles 6–12 cm long, mostly hirsute; petiolules 1–6 cm long, mostly hirsute; leaflets usually segmented; leaflets/leaf segments 11–130 in number, linear-elliptic to elliptic, or oblanceolate, cuneate at the base, acuminate or acute at the apex, lobed or entire, 3–12 cm long, 1–4.5 cm wide, glabrous above, villose, rarely glabrous beneath. Flowers solitary, terminal; involucre bracts 1–2 in number, leaf-like, relatively distinct from sepals; sepals 3–5 in number, deltoid-orbicular to orbicular, 1–2.5 cm long, 0.8–2 cm wide, mostly rounded at the apex, hispidulous or glabrous on the abaxial side; petals 5–8 in number, pale violet-red or purple-red; filaments purple; anthers yellow; disk up to 1 mm high, flat or waved, red; carpels 1–5, mostly 2–3, in number, tomentose or glabrous, hairs 1.5–2 mm long, yellow, brown or pink; stigmas sessile, red, c. 1.5 mm wide. Follicles long-ovoid when young. Figs 5.32A, 5.32B, 5.32C, 5.32D.

CHROMOSOMES. $2n = 20$ (Barber, 1941; Dark, 1936; Langlet, 1927; Stern, 1944; see each subspecies for additional information).

DISTRIBUTION. Widely distributed from the Iberian Peninsula to the Balkans via France, Italy and Switzerland (Map 5.32).

NOTES. *Paeonia officinalis* is the typical species of the genus *Paeonia*, but its circumscription was not clear and it was confused both with *P. peregrina* (de Candolle, 1818, 1824; Baker, 1884; Lynch, 1890; Huth, 1891), until the work of Stapf (1918), and with *P. mascula* (e.g. Fiori, 1898). The species is extremely variable because of great variation in natural populations and extensive cultivation, as demonstrated by the more than 20 specific and many infraspecific synonyms included here. For example, the entity in the Iberian Peninsula and SW France has leaflets/leaf segments numbering more than 50, which are mostly lobed, whereas that in the Balkans has no more than 24 leaflets/leaf segments, which are mostly entire. In the Iberian Peninsula and SW France, the great majority of carpels are glabrous (over 90%), whereas they are totally tomentose in all the other populations. However, the peony here circumscribed cannot be clearly split, and all the differences, even the clear ones mentioned above, are bridged by intermediate forms.

Paeonia officinalis is morphologically polytypical with its types closely correlated with geography. Five types could be recognised and are treated here as five subspecies.

- 1a. Carpels glabrous, occasionally sparsely hirsute; sepals mostly glabrous; leaflets/leaf segments usually obtuse at the apex, often lobed; stems mostly glabrous 32e. subsp. *microcarpa*
- 1b. Carpels tomentose; sepals usually pubescent; leaflets/leaf segments usually acuminate at apex, entire, rarely lobed; stems hirsute or glabrous.
 - 2a. Leaflets/leaf segments 11–24 in number, 2–4.5 cm wide, glabrous or sparsely villose beneath; sepals glabrous or sparsely pubescent 32b. subsp. *banatica*
 - 2b. Leaflets/leaf segments 19–130 in number, 1–3 cm wide, always villose beneath; sepals always pubescent.
 - 3a. Leaflets/leaf segments 35–130 in number, always with some lobed, 1–2 cm wide 32c. subsp. *huthii*
 - 3b. Leaflets/leaf segments 19–45 in number, all entire or occasionally very few lobed, 1–3 cm wide.
 - 4a. Leaves villose-floccose beneath, hairs flattened at base 32d. subsp. *italica*
 - 4b. Leaves hairy but never villose-floccose beneath, hairs cylindrical 32a. subsp. *officinalis*

Fig. 5.32A (opposite). *Paeonia officinalis* subsp. *officinalis*: **a**, the lower part of the plant; **b**, a lower leaf; **c**, a flower; **d**, a flower with petals and stamens shed, showing the disk and carpels. Drawn by Miss CAI Shu-Qin.



32a. *Paeonia officinalis* subsp. *officinalis*

Paeonia peregrina Mill. var. *officinalis* (Retz.) Huth, *Bot. Jahrb. Syst.* 14(3): 270 (1891). *Paeonia peregrina* Mill. f. *officinalis* (Retz.) Rouy & Foucaud, *Fl. France* 1: 146 (1893).

Paeonia officinalis L. var. *albicans* Sabine, *Trans. Hort. Soc. London* 2: 275 (1817). TYPE: not designated.

Paeonia officinalis L. var. *anemoniflora* Hook., *Icon. filic.* 1(2): tab. nostr. 3175 (1832). TYPE: W. J. Hooker's tab. cited (holotype!).

Paeonia officinalis L. var. *carnescens* Sabine, *Trans. Hort. Soc. London* 2: 275 (1817). TYPE: not designated.

Paeonia officinalis L. var. *rubra* Sabine, *Trans. Hort. Soc. London* 2: 274 (1817). TYPE: not designated.

PHENOLOGY. Flowering from late April to early June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 20$ (Barber, 1941; Dark, 1936; Stern, 1944; the present work with the voucher: Switzerland, Mt Generoso, D. Y. Hong et al. H01029).

HABITAT AND DISTRIBUTION. In sparse pine or oak woods, thickets, or mountain meadows in limestone areas at an altitude of 500–2,000 m. Croatia, N Italy, Slovenia and S Switzerland; relatively common in N Italy (Map 5.32).

ADDITIONAL SPECIMENS EXAMINED. CROATIA, Istria: Mt Maggiore, c. 1,000 m, 15 July 1902, A. Ginzberger, s.n. (WU); *loc. eodem*, 21 June 1898, Saint-Lager s.n. (B); *loc. eodem*, 1,300 m, May 1898, L. Richter s.n. (B, E, TUB); *loc. eodem*, 9 June 1887, Kaemer s.n. (B); *loc. eodem*, 31 May 1959, Baschant 1054 (B); *loc. eodem*, June 1869, A. M. Smith s.n. (WU); *loc. eodem*, 26 May 1870, A. M. Smith s.n. (TUB); *loc. eodem*, 29 May 1891, Troyer s.n. (GZU); *loc. eodem*, 14 June 1897, Evers s.n. (GZU); *loc. eodem*, 30 May 1898, Evers s.n. (BM, GZU); *loc. eodem*, 22 May 1899, Untchi s.n. (E); *loc. eodem*, 7 June 1958, W. Sauer 2361 (SA) and 2365 (SA); *loc. eodem*, 1962, H. Heske s.n. (GZU); *loc. eodem*, 1,390 m, 7 June 1958, H. Schaefflein 58-116 (GZU); Plavnik, in forests, 6 June 1898, Evers s.n. (GZU). **ITALY, Emilia:** Modena, Mt Madino, 500 m, 24 June 1933, D. V. Mori s.n. (B). **Lombardy:** 1,220–1,830 m, 28 May 1867, P. Porta s.n. (WU); *loc. eodem*, 17 Apr. 1868, P. Porta s.n. (WU); *loc. eodem*, 1,220–1,520 m, 17 June 1872, P. Porta s.n. (BM); Lecco, Corni di Canzo, 6 May 1871, G. C. Joad 1882 (K); *loc. eodem*, 4 June 1887, J. F. Hamilton s.n. (E); Mt Sera, 1,770 m, 1 May 1865, H. Groves s.n. (BM); Mt Generoso, 1833, Schoerer s.n. (BM); *loc. eodem*, 1953, H. Heske s.n. (GZU); *loc. eodem*, June 1893, Mercier s.n. (G); *loc. eodem*, 1893, H. Thomas s.n. (G); *loc. eodem*, 5 June 1857, J. Murot s.n. (G); *loc. eodem*, May 1932, L. T. Patzki 16976 (B); *loc. eodem*, 7 June 1865, E. Burnat s.n. (WU); *loc. eodem*, 18 June 1872, Duthie s.n. (E); *loc. eodem*, 21 June 1872, Duthie s.n. (BM); *loc. eodem*, 4 June 1886, Cox s.n. (BM). **Trentino:** Mori, Mt Brugius, 21 May 1886, Evers s.n. (BM, GZU); Tirolia Austr., Val di Ledro, 1,500–2,000 m, June 1893, P. Porta s.n. (GZU, WU); *loc. eodem*, 1,300–1,500 m, 1884, P. Porta s.n. (BM, GZU, K, WU); *loc. eodem*, 1,500 m, limestones, June 1896, Foletto s.n. (B, GZU); *loc. eodem*, 1,520–1,830 m, June 1873, P. Porta s.n. (BM). Arco: Mt Greino, 1,200 m, May 1956, Lippert 144 (B); Sardinia, 12 May 1869, V. Lieors s.n. (WU); S Mezzo lombardo, 29 May 1887, G. & W. Sauer 34831 (SA); Mt Cles, Nonsberg, 1,500–1,700 m, 27 Aug. 1902, Handel-Mazzetti s.n. (WU); Mt Baldo, 1,200–1,800 m, limestones, May 1894, G. Rigo s.n. (B, BM, E, LD, WU); *loc. eodem*, 1,200–1,800 m, limestones, June 1894, G. Rigo s.n. (B, BM, E, LD, WU); *loc. eodem*, 1,000–1,800 m, June 1897, G. Rigo s.n. (LD); *loc. eodem*, 1,000 m, June 1904, G. Rigo s.n. (BM, K, RO); *loc. eodem*, July 1904, G. Rigo s.n. (BM, K, RO); *loc. eodem*, 24 June 1914, G. Rigo s.n. (B, BM); Mt Baldo, Brentonico, 5 June 1969, J. Brunner s.n. (GZU); Mt Baldo, 1952, H. Heske s.n. (GZU); *loc. eodem*, A. Krner s.n. (G); Mt Baldo, near summit, 16 June 1909, A. Richter s.n. (B, BC, GZU); Mt Baldo, 3 June 1873, P. G. Strob s.n. (WU); *loc. eodem*, June 1898, E. Riccavdi s.n. (BM); Mt Baldo, San Valentino, 1,300 m, 24 June 1903, Behrendsen s.n. (B); Mt Baldo, Corna Piono, 1,300 m, 3 June 1961, W. Sauer 4169 (SA); Mt Baldo, Gordosce-Gebiet, 11 Aug. 1973, H. J. Leep s.n. (SA); Mt Baldo, Magla, Kerner s.n. (WU); Mt Pastello, 200–1,000 m, 6 June 1908, G. Rigo s.n. (LD); *loc. eodem*, June 1900, G. Rigo s.n. (LD); *loc. eodem*, 800 m, Apr. 1902, G. Rigo s.n. (B); Calliano, 28 Apr. 1918, F. Wettstein s.n. (WU). **Trieste:** s. loc.,

May 1897, R. Gerold s.n. (GZU); *s. loc.*, *Bentham* s.n. (K); Istria, NNE Trieste, 450 m, 23 May 1972, G. & W. Sauer 14571 (SA). Berg Ravnig, 1909, M. Heider s.n. (GZU); Mt Kokus, June 1926, A. Meebold s.n. (K); Mt Spaccato, 27 July 1884, V. Engelhardt s.n. (B); *loc. eodem*, 8 May 1895, V. Engelhardt s.n. (B); *loc. eodem*, 12 May 1888, V. Engelhardt s.n. (BC, GZU); *loc. eodem*, 20 May 1888, V. Engelhardt s.n. (BM); *loc. eodem*, 4 May 1886, V. Engelhardt s.n. (B, GZU); *loc. eodem*, 10 May 1887, V. Engelhardt s.n. (GZU); *loc. eodem*, 22 May 1922, V. Engelhardt s.n. (B). Prosecco, K. Krasan s.n. (GZU); Cheina, 320 m, 11 May 1905, F. C. Crauford s.n. (E). **Tuscany**: 1,550 m, 4 June 1979, G. & W. Sauer 24369 (SA); Alpi Apuane, Pisanino, 1,700 m, 1 July 1871, S. Sommier s.n. (G). **Verona**: Hügel, K. V. Koellenstein s.n. (BM, GZU). **SLOVENIA**: **Adelsberg** (Postojina), Nanos, 1,100 m, 4 June 1983, H. Melzer s.n. (GZU); *loc. eodem*, 5 June 1983, H. Melzer s.n. (GZU); *loc. eodem*, 23 June 1872, Sonklar s.n. (WU); *loc. eodem*, 900 m, 24 May 1929, O. Fiedler s.n. (B); *loc. eodem*, 3 June 1911, O. Wettstein s.n. (WU); *loc. eodem*, 1 June 1883, Sbapt s.n. (WU); *loc. eodem*, 17 May 1897, Kolasochek s.n. (GZU); Adelsberg, Javornik, 800 m, 22 May 1929, O. Fiedler s.n. (B); Adelsberg, 1864, Kerner s.n. (WU); *loc. eodem*, 15 May 1959, A. Hachtmann s.n. (GZU). **Basovizza**, 11 May 1905, Evers 200 (WU); *loc. eodem*, 21 May 1905, Evers 201 (WU); *loc. eodem*, 26 May 1905, Evers 202 (WU); *loc. eodem*, 400 m, 16 May 1902, Handel-Mazzetti s.n. (WU). **Divaca** to St. Canzian, 30 June 1937, Ipse s.n. (WU); *loc. eodem*, May 1901, O. Krebs s.n. (B); *loc. eodem*, May 1910, M. Heider s.n. (GZU); Lipica, 30 Apr. 1902, Evers, s.n. (GZU); *loc. eodem*, 13 May 1902, Evers s.n. (GZU); *loc. eodem*, 1861, Veselsky s.n. (BM); *loc. eodem*, 4 May 1877, G. C. Spreitzenhofer s.n. (B, WU); *loc. eodem*, May 1866, Wiendlmayr s.n. (B); *loc. eodem*, 24 July 1883, V. Engelhardt s.n. (B). **Slavnik**: above Podgorje, 700 m, 4 June 1970, E. Mayer et al. 79111 (B, GZU, M, TUB); Slavnik, 800 m, 21 May 1962, H. Heske s.n. (GZU); *loc. eodem*, 4 June 1895, Untchi s.n. (GZU); *loc. eodem*, 16 May 1908, Handel-Mazzetti s.n. (WU); *loc. eodem*, 14 May 1882, Engelhardt s.n. (B, K); *loc. eodem*, 850–1,000 m, 7 June 1961, G. Wagenitz & T. Wraber 91 (B); *loc. eodem*, May 1911, Arbesser s.n. (GZU); above Kozina, 700 m, 15 May 1967, E. Mayer s.n. (M); above Wald, c. 750 m, 30 May 1966, J. Grau s.n. (M). **SWITZERLAND**, **Lugano**: Lugano, E. Pritzel 193 (B); *loc. eodem*, 9 June 1892, C. Pasgnale s.n. (G); Lugano, Mt Generoso, 45°55'N, 9°01'E, 1,350–1,600 m, limestones, 22 June 2001, D. Y. Hong, X. Q. Wang & Y. M. Yuan H01029 (A, BM, CAS, K, MO, P, PE).

32b. *Paeonia officinalis* subsp. *banatica* (Rochel) Soó, *Növényföldrajz*, 146 (1945) and *Acta Bot. Acad. Sci. Hung.* 6: 141 (1960); Cullen & Heywood, *Feddes Repert.* 69: 34 (1964) and in Tutin et al., *Fl. Europ.* 1: 243 (1964); Akeroyd in Tutin et al., *Fl. Europ.* edn 2, 1: 293 (1993). *Paeonia banatica* Rochel, *Pl. Banat. rar.*, 48, tab. 11, fig. 25 (1828); Reichenbach, *Icon. fl. germ. helv.* 4: 28, tab. 4741 (1840); Stern, *Study Gen. Paeonia*, 72 (1946). *Paeonia peregrina* Mill. var. *banatica* (Rochel) Huth, *Bot. Jahrb. Syst.* 14(3): 270 (1891). *Paeonia feminea* (L.) Desf. var. *banatica* (Rochel) Gürke in Richter, *Pl. eur.* 2: 403 (1903). *Paeonia officinalis* L. var. *officinalis* subvar. *banatica* (Rochel) Hayek, *Prodr. fl. penins. Balcan.* 1 (in *Fedde Rep. Sp. nov. Beih.* 30 (1)): 298 (1927). TYPE: Rochel's tab. cited (holotype!).

Paeonia rosea auct. non J. St.-Hil.: Host in *Fl. austriac.* 2: 64 (1831), pro parte, quoad pl. Banat.

PHENOLOGY. Flowering from April to late May; fruiting in August.

CHROMOSOME NUMBER. $2n = 20$ (Stern, 1944; the present work with the voucher: Serbia, Banat, D. Y. Hong et al. H03020 (PE)).

HABITAT AND DISTRIBUTION. In thickets or sparse woods of sand soil at altitudes below 1,000 m. Bosnia-Herzegovina, Hungary (S), Romania (SW), and Serbia (Map 5.32).

NOTES. *Paeonia officinalis* subsp. *banatica* is rather distinct from the typical one. It has fewer leaflets/leaf segments, mostly 13–18, rarely down to 11 and up to 24, compared to subsp. *officinalis* with mostly more than 25. The leaflets/leaf segments in this subspecies are wider than those in the other subspecies (2–4.5 rather than 1–3 cm); they are also less densely villose or even glabrous

beneath. Sepals are hispidulous or glabrous in this subspecies, whereas they are always pubescent in subsp. *officinalis*, subsp. *italica*, and subsp. *huthii* (Fig. 5.32B).

Seeds ellipsoid, black, 7–8 mm long, c. 5 mm in diameter.

The roots in this subspecies are always tuberous, and sometimes tandom-tuberous, rather long, running horizontally and vertically. Therefore, Rochel's (1828) figure of the root is wrong, whereas Reichenbach's (1840) figure of the root is correct. New shoots were found rising from tubers in our field observation at Deliblat in the Banat Region of Serbia in 2003, and thus this subspecies may be vegetatively reproductive to some extent.



Fig. 5.32B. *Paeonia officinalis* L. subsp. *banatica* (Rochel) Soó: the upper part of the stem. Drawn by Miss CAI Shu-Qin.

ADDITIONAL SPECIMENS EXAMINED. BOSNIA-HERZEGOVINA, Rogatica, June 1898, *V. Čurčić* s.n. (K); Mt Rudinica, 960 m, 21 May 1911, *K. Maly* s.n. (K). **HUNGARY, Baranya**: Mecsek Mts, near Pècsvárád, 23 June 1951, *H. Horanszky* s.n. (BP); *loc. eodem*, 23 Apr. 1951, *H. Horanszky* s.n. (BP); *loc. eodem*, June 1937, *F. Glatz* s.n. (BP); *loc. eodem*, 20 Apr. 1946, *J. Papp* s.n. (BP); *loc. eodem*, 10 May 1936, *R. de Soó* 1240 (BP); *loc. eodem*, 3 May 1935, *F. Kresadlo* s.n. (BP); *loc. eodem*, 21 Apr. 1946, *J. Papp* s.n. (BP); *loc. eodem*, 650 m, 29 May 1931, *L. Vajda* s.n. (BP); *loc. eodem*, 26 Apr. 1930, *S. Javorka* s.n. (BP); *loc. eodem*, 350 m, 9 May 1958, *A. Boros* s.n. (BP); *loc. eodem*, 400 m, 12 May 1935, *Z. Karpati* s.n. (BP); *loc. eodem*, 680 m, May 1935, *L. Vajda* s.n. (BP); *loc. eodem*, 17 Apr. 1949, *B. Levne* s.n. (BP); *loc. eodem*, 26 May 1956, *S. Imréné* s.n. (BP); *loc. eodem*, 3 May 1951, *Bánó Lehel* s.n. (BP); *loc. eodem*, 300 m, 5 May 1934, *Z. Karpati* s.n. (BP); Mecsek Mts, near Zobak-Pusztá, c. 400 m, 10 May 1958, *A. Boros* s.n. (BP); Mecsek Mts, 330 m, 7 May 1996, *V. Stojšić* s.n. (NSAD); *loc. eodem*, 604 m, 7 June 1996, *V. Stojšić* s.n. (NSAD). **ROMANIA, Banat region**: Bazias, 1835, *Rochel* s.n. (BM, BP); *loc. eodem*, 20 June 1905, *G. Lengyel* s.n. (BP); *loc. eodem*, Apr. 1888, *G. Lindauer* s.n. (BM, BP, G, K); *loc. eodem*, 9 May 1896, *J. Wagner* s.n. (BP); *loc. eodem*, 25 Apr. 1908, *J. Wagner* s.n. (BP); *loc. eodem*, 24 Apr. 1908, *J. Wagner* s.n. (BP); *loc. eodem*, 14 Apr. 1874, *F. Bohatsch* s.n. (BP); *loc. eodem*, 1 Apr. 1874, *Simkovics* s.n. (BP); *loc. eodem*, 31 May 1874, *Simkovics* s.n. (BP); *loc. eodem*, 31 May 1874, *Borbás* s.n. (BP); *loc. eodem*, Apr. 1874, *Borbás* s.n. (BP); *loc. eodem*, 100–200 m, 12 Apr. 1914, *S. Javorka & G. Timko* 739 (BM, BP, E, F, G, GZU, K, LD, M, US, W) and 8 Apr. 1914, *S. Javorka & G. Timko* s.n. (BP); *loc. eodem*, 1888, *A. de Degen* s.n. (K); *loc. eodem*, 10 May 1840, *Wierzbicki* s.n. (E, K, W); *loc. eodem*, May 1841, *Wierzbicki* s.n. (E, K, W). **SERBIA, Banat region**: Deliblat, June 1908, *J. Wagner* s.n. (BP); *loc. eodem*, 26 June 1911, *J. Tuzson* s.n. (BP); *loc. eodem*, May 1912, *G. Lengyel* s.n. (BP); *loc. eodem*, 21 Apr. 1917, *S. Javorka & G. Timko* s.n. (BP); Deliblat, Peščara, 15 June 1995, *D. Javic* s.n. (NSAD); *loc. eodem*, *A. Pichlev* s.n. (BEO); *loc. eodem*, 10 May 1997, *V. Stojšić* s.n. (NSAD); Deliblat, Flamunda, 26 Apr. 1967, *V. Nikolic & N. Diklic* s.n. (BEO); *loc. eodem*, 11 May 1913, *M. D. Sandor* s.n. (BP); *loc. eodem*, 25 May 1961, *H. Metlesics* s.n. (W); *loc. eodem*, 29 May 1913, *L. de Thalsz* s.n. (BP); *loc. eodem*, 9 June 1887, *A. de Degen* s.n. (E); *loc. eodem*, 5 km, SW of Susara, sand areas, glades of *Populus–Quercus–Pinus* forests, 17 Aug. 2003, *D. Y. Hong, O. Vasic & V. Stojšić* H03020 (PE); Flamunda, 100 m, 14 Oct. 1962, *E. Mayer* s.n. (M); Mokra Gora, 13 July 1998, *Stevanovic et al.* s.n. (BGUB); *loc. eodem*, 4 July 1998, *Jovanovic et al.* s.n. (BGUB); Deliblat, Kincstari Homokpusztá, June 1909, *J. Wagner* s.n. (W); *loc. eodem*, Apr. 1918, *J. Wagner* s.n. (BM); Tara Planina, 3 July 1998, *Jovanovic et al.* s.n. (BGUB).

32c. *Paeonia officinalis* subsp. *huthii* Soldano, *Att. Soc. Ital. Sci. Nat. Museo Civ. Stor. Nat. Milano* 133 (10): 114 (1993); Passalacqua & Bernardo, *Webbia* 59(2): 250 (2004). *Paeonia officinalis* L. subsp. *villosa* (Huth) Cullen & Heywood, *Feddes Repert.* 69: 34 (1964) and in Tutin *et al.*, *Fl. Europ.* 1: 243 (1964). *Paeonia officinalis* L. var. *villosa* (Desf.) Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 555 (1923), pro parte, excl. f. *microphylla*; Fiori, *Nuov. Fl. Italia* 1: 689 (1924), nom. illeg., non *Paeonia villosa* Desf., *Tabl. école bot.*, 126 (1804). *Paeonia peregrina* Mill. var. *villosa* Huth, *Bot. Jahrb. Syst.* 14: 270 (1891), pro parte, excl. syn. *tartarica*. *Paeonia humilis* Retz. var. *villosa* (Huth) Stern, *J. Roy. Hort. Soc.* 68: 129 (1943); Stern, *Study Gen. Paeonia*, 106 (1946). *Paeonia feminea* (L.) Desf. var. *villosa* (Desf.) Gürke in Richter, *Fl. eur.* 2: 402 (1903), pro parte, excl. quoad syn. *villosa*. TYPE: France, Lozère, Mende, *Prost* s.n. (lectotype here designated: G!; isolectotype K!). *Paeonia microcarpa* Salm-Dyck, *Hort. Dyck.*, 368 (1834). TYPE: not designated. *Paeonia monticola* Jord. in Jordan & Fourreau (eds), *Icon. fl. Eur.* 2: 37, tab. 319 (1903). TYPE: Jordan's tab. cited (lectotype here designated!). *Paeonia anemoniflora* auct. non Hook.: Hort, *Garden* 31: tab. 512, fig. 3 (1887). *Paeonia peregrina* Mill. f. *angustata* Rouy & Foucaud, *Fl. France* 1: 146 (1893). TYPE: not designated. *Paeonia peregrina* Mill. var. *compacta* G. Anderson, *Trans. Linn. Soc. London* 12: 279 (1818).

Paeonia hirsuta auct. non Mill.: Saint-Hilaire, *Pl. France* 4: tab. 302 (1809).

Paeonia peregrina auct. non Mill.: G. Anderson, *Trans. Linn. Soc. London* 12: 277 (1818), pro parte, excl. var. *byzantina*.

PHENOLOGY. Flowering from May to early June; fruiting in August and September.

CHROMOSOME NUMBER. $2n = 20$ (Langlet, 1927; the present work with the voucher: France, Alpes-Maritimes, N of Grasse, D. Y. Hong et al. H01009).

HABITAT AND DISTRIBUTION. Growing in sparse *Quercus*, *Fagus* or *Quercus-Fagus* forests or in pastures with sparse *Pinus sylvestris* trees, in limestone areas, at altitudes from 900 to 1,970 m. A relatively narrowly distributed entity found in NW Italy (Imperia Prov.), and SE and S France. In S France (Herault and le Vigan) the entity meets subsp. *microcarpa* (Map 5.32).

ADDITIONAL SPECIMENS EXAMINED. FRANCE, ALPES-MARITIMES: Caussols, 28 May 1891, V. Banafons s.n. (BM); loc. eodem, 5 June 1930, A. Becherer s.n. (G); loc. eodem, 1,100 m, May 1965, R. Salanus s.n. (G); Caussols, 3 km W of St. Lambert, 900 m, 20 May 1972, D. Podlech 22832 (G, SA); Caussols, 1,200 m, June 1838, G. Desplantes s.n. (B); Caussols, Verignon, J. Gay s.n. (K); Thorenc, near Col de la Sine, 11 May 1938, M. S. Campell & Steuger s.n. (BM); between Vence and Coursegoules, 14 May 1860, G. Thuret s.n. (P); Coursegoules, 1,000 m, 8 June 1938, B. de Retz 14784 (B); loc. eodem, 20 Apr. 1935, G. Beauverd s.n. (G); loc. eodem, 16 May 1937, G. Beauverd s.n. (G); St. Martin de Entraun, Ampus, May 1916, C. Duffour s.n. (B, G); Arnas, Rhone, in forests, 5 July 1878, M. Gandoger s.n. (G); loc. eodem, 27 Apr. 1879, M. Gandoger s.n. (WU); loc. eodem, in forests, May 1898, M. Gandoger s.n. (G, K); loc. eodem, in forests, Aug. 1898, M. Gandoger s.n. (G, K); loc. eodem, June 1900, M. Gandoger s.n. (B, GZU); loc. eodem, in Umbrosis, July 1902, M. Gandoger s.n. (M); loc. eodem, in *Quercus* forests, July, 1902, M. Gandoger s.n. (M); N of Grasse, N 43°43'N, 6°52'E, 1,130 m, *Quercus-Fagus* forests, limestones, 26 May 2001, D. Y. Hong, X. Q. Wang & A. Fridlender H01009 (A, BM, CAS, K, MO, PE); Nice, Monton, Le Grammondo, above Castellar, 43°53'N, 7°30'E, 1,130 m, pastures with scattered trees of *Pinus sylvestris*, 27 May 2001, D. Y. Hong, X. Q. Wang & A. Fridlender H01012 (A, BM, CAS, K, MO, PE). **BASSES-ALPES:** Bois am Cold'allous, 27 May 1894, E. Reverchon s.n. (G); Annot, 44°N, 6°E, 1,900 m, in dry forests, 30 May 1887, E. Reverchon & A. Derbez s.n. (B, BM, E, G, GZU, K, RO, WU); Annot-Colmars, 20 km from Annot, near St. Michel Peyresq, 1,320 m, 9 June 1967, B. Verdrount 4465 (K); Fugeret La Montagne, 24 June 1888, E. Reverchon & A. Derbez 256a (G, WU); loc. eodem, 29 July 1888, E. Reverchon & A. Derbez 256b (G, W); loc. eodem, 19 July 1888, E. Reverchon & A. Derbez 258 (WU); loc. eodem, 2 Aug. 1888, E. Reverchon & A. Derbez s.n. (E); Fugeret, 15 June 1888, E. Reverchon & A. Derbez s.n. (E); Le Caire, 3 May 1858, E. Ayasse s.n. (G); Ribiers, Mt Rognonse, 11 June 1873, E. Reverchon s.n. (WU). **GARD:** le Vigan, limestones, May/June 1876, Diomete s.n. (BM); loc. eodem, May 1879, L. Anthouard s.n. (K); loc. eodem, June 1879, L. Anthouard s.n. (K); loc. eodem, 19 May 1862, C. Billot s.n. (BM, G); le Vigan, Cessonnie, 7 May 1903, Foures s.n. (G); loc. eodem, 12 May 1904, Foures s.n. (B, G); le Vigan, Ventouse, C. Lombark s.n. (K). **HAUTES-ALPES:** s. loc., May 1927, G. Beauverd s.n. (G); near Embrun, 3 June 1860, Bontigny s.n. (G); Embrun, Seguret, 15 June 1902, L. Girad s.n. (BM); loc. eodem, 8 July 1885, G. Rouy s.n. (G); loc. eodem, 11 June 1899, Franchet s.n. (B); loc. eodem, 30 May 1872, E. Reverchon s.n. (WU); loc. eodem, 17 June 1894, A. Faure s.n. (G); loc. eodem, 21 June 1885, A. Pellat s.n. (BM, G); loc. eodem, 11 June 1898, G. Gautier s.n. (G); Embrun, 11 May 1858, E. Ayasse s.n. (G); between Briancon and Barbin, near Guillestre, 1,000 m, 7 June 1868, E. Reverchon s.n. (K); loc. eodem, June 1890, E. Reverchon 138 (BM); Mt Montagne, above Barret le Bas, 1,100 m, *Fagus* forests, 13 May 1969, A. Charpin & W. Greuter 8289 (G); Ribiers, Mt Rognonse, 11 June 1873, E. Reverchon s.n. (WU). **HERAULT:** Montpellier, Pic St. Loup, 1896, Salzmann 83 (G); loc. eodem, 9 June 1836, P. Bubani s.n. (G); loc. eodem, 20 Apr. 1857, A. Maillard s.n. (K); loc. eodem, May 1818, Richard s.n. (G); loc. eodem, May 1855, Planchon s.n. (G); loc. eodem, J. L. A. Bonneau s.n. (G); loc. eodem, 1892, Eavran s.n. (E); loc. eodem, 1825, W. Amott s.n. (E);

Escandorgue Pertus, May 1867, *M. Puech* s.n. (G); St. Martin de Londres, near Montpellier, Apr. 1893, *E. Mandan* s.n. (BM); *loc. eodem*, 22 May 1893, *E. Gadeceau* s.n. (BM); Montpellier, La Serane, 600–700 m, 5 May 2001, *A. Fridlender* H01007 (A, CAS, K, MO, PE). **Lozere**, *s. loc.*, *Requien* s.n. (G); Mende, 1832, *Boivin* s.n. (G). **PROVENCE**: *s. loc.*, 1839, *M. Perreymond* s.n. (G), Seranon, Mt Lachen Audessus, 18 July 1877, *L. Leresche* s.n. (G). **ITALY, ALPES-MARITIMES**: near San Remo, Mt Toraggio, 1,970 m, 4 Aug. 1886, *G. Mari* s.n. (G); *loc. eodem*, 1,970 m, 30 Aug. 1888, *G. Mari* s.n. (G); Imperia, Alpi Ligure, 1,800–1,920 m, 31 July 1984, *W. Lippert & H. Merxmuller* 20177 (M).

32d. *Paeonia officinalis* subsp. *italica* Passalacqua & Bernardo, *Webbia* 59(2): 250 (2004). TYPE:

Italy, Prati di Tivo, Abruzzi, Gran Sasso d'Italia, 1,450 m, 13 July 2001, *L. Bernardo & N. G. Passalacqua* s.n. (holotype CLU, n.v.).

Paeonia peregrina Mill. var. *villosa* Huth, *Bot. Jahrb. Syst.* 14(3): 270 (1891), pro parte, excl. syn. *tartarica*. *Paeonia humilis* Retz. var. *villosa* (Huth) Stern, *J. Roy. Hort. Soc.* 68: 129 (1943), pro parte, excl. pl. S France; Stern, *Study Gen. Paeonia*, 106 (1946), pro parte, excl. pl. S France.

PHENOLOGY. Flowering from May to early June; fruiting in August or September.

CHROMOSOME NUMBER. $2n = 20$ (Passalacqua & Bernardo, 2004).

HABITAT AND DISTRIBUTION. Growing in open communities at an altitude of 650–1,800 m. Confined to central Italy, Croatia and N Albania (Map 5.32).

ADDITIONAL SPECIMENS EXAMINED. **ALBANIA**, N Albania Distr., Sala Felsgerolle, Abasa, c. 1,500 m, 12 June 1916, *I. Dorfler* 81 (WU). **CROATIA**, Dalmacija, *s. coll.* s.n. (K). **ITALY, Abruzzi**: Mt Morrone, 24 July 1879, *N. A. Pedicino & E. Mori* s.n. (RO); *loc. eodem*, 1909, *Froneili* s.n. (BM); *loc. eodem*, 1 Aug. 1873, *E. Levier* s.n. (BM); *loc. eodem*, 1,220 m, June 1881, *Refet* s.n. (BM); Orfenta, *N. A. Pedicino* s.n. (RO). Mt Maiella: 1,520 m, June 1885, *H. Groves* s.n. (BM); *loc. eodem*, *E. Levier* s.n. (GZU). Mt Corno: *G. A. Paquale* s.n. (BM); *loc. eodem*, 670 m, 20 July 1871, *Robert* s.n. (E); *loc. eodem*, 1,500–1,800 m, 16 Aug. 1856, *E. & A. H. du Pavillon* 091 (G, W). **Marches**: Mt Castello, 800 m, 23 May 1904, *Handel-Mazzetti* s.n. (WU); Ascoli Piceno, Mt Sibillini, 28 June 1886, *E. Marini* s.n. (RO); Pizzo di Sevo (Ascoli Piceno), 15 June 1886, *C. Castelli* s.n. (RO).

32e. *Paeonia officinalis* subsp. *microcarpa* (Boiss. & Reut.) Nym., *Consp. fl. eur.* 1: 22 (1878);

Muñoz-Garmendia & Navarro in Castroviejo *et al.* (eds), *Fl. Iberica* 3: 148 (1993); Akeroyd in Tutin *et al.* (eds), *Fl. Europ.* edn 2, 1: 293 (1993), pro parte, excl. syn. *P. paradoxa* G. Anderson. *Paeonia microcarpa* Boiss. & Reut., *Pugill. pl. Afr. bor. Hispan.*, 3 (1852). *Paeonia peregrina* Mill. f. *microcarpa* (Boiss. & Reut.) Rouy & Foucaud, *Fl. France* 1: 146 (1893). *Paeonia officinalis* L. var. *microcarpa* (Boiss. & Reut.) Samp., *Fl. Port.* edn 2, 219, 741 (1946). TYPE: Spain, Sierra de Gredos, Pinar de Hoyocero, 2 Sep. 1841, *Reuter* s.n. (lectotype designated by Burdet *et al.* 1988, G!); Spain, in montibus de Avila Castellae novae, 1841, *Reuter* s.n. (syntype G!).

Paeonia humilis Retz., *Observ. bot.* 3: 35 (1783); Willdenow, *Sp. pl.* 2(2): 1221 (1799); Sims, *Bot. Mag.* 35: tab. 1422 (1812); de Candolle, *Syst. nat.* 1: 392 (1818) and *Prodr.* 1: 66 (1824); Anderson, *Trans. Linn. Soc. London* 12(1): 271 (1818); Stern, *J. Roy. Hort. Soc.* 68: 129, and *Study Gen. Paeonia*, 104, cum tab (1946). *Paeonia officinalis* L. subsp. *humilis* (Retz.) Cullen & Heywood, *Feddes Repert.* 69: 34 (1964) and in Tutin *et al.*, *Fl. Europ.* 1: 243 (1964). *Paeonia officinalis* L. var. *humilis* (Retz.) Asch. & Graebn., *Syn. mitteleur. Fl.* 5(2): 556 (1923). *Paeonia peregrina* Mill. var. *humilis* (Retz.) Huth, *Bot. Jahrb. Syst.* 14(3): 270 (1891). *Paeonia feminea* (L.) Desf. var. *humilis* (Retz.) Gürke in Richter, *Fl. eur.* 2: 402 (1903). TYPE: Sims' tab. cited (neotype here designated!).

Paeonia rosea J. St.-Hil., *Pl. France* 4: tab. 303 (1809). TYPE: Saint-Hilaire's tab. cited (holotype!).

Paeonia villarsii Jord. in Jordan & Foureau, *Icon. Fl. Eur.* 2: 37, tab. 318 (1903). TYPE: Jordan's tab. cited (holotype!).

Paeonia modesta Jord. in Jordan & Fourreau, *Icon. Fl. Eur.* 2: 38, tab. 321 (1903). TYPE: Jordan's tab. cited (holotype!).

Paeonia leiocarpa Jord. in Jordan & Fourreau, *Icon. Fl. Eur.* 2: 38, tab. 320 (1903). TYPE: Jordan's tab. cited (holotype!).

Paeonia paradoxa G. Anderson var. *leiocarpa* DC., *Prodr.* 1: 66 (1824). *Paeonia peregrina* Mill. var. *leiocarpa* (DC.) Coss., *Notes pl. crit.* 3: 93 (1851); Willkomm in Willkomm & Lange, *Prodr. fl. hispan.* 3: 975 (1880). *Paeonia peregrina* Mill. f. *leiocarpa* (DC.) Rouy & Foucaud, *Fl. France* 1: 145 (1893). *Paeonia officinalis* L. var. *humilis* (Retz.) Asch. & Graebn. f. *leiocarpa* (DC.) Asch. & Graebn., *Syn. mitteleur.* Fl. 5(2): 556 (1923). TYPE: France, "Monte Serane", s. coll. s.n. (lectotype here designated, G!).

Paeonia villosa Desf., *Tabl. école bot.*, 126 (1804), nom. nud.

Paeonia peregrina Mill. var. *genuina* Lazaro, *Comp. fl. Españ.* edn 2, 2: 357 (1907). TYPE: not designated!

Paeonia humilis Retz. var. *gallica* Salm-Dyck, *Hort. Dyck.*, 369 (1834). TYPE: not designated!

Paeonia peregrina Mill. var. *paradoxa* auct. non G. Anderson (1818): Gautier, *Cat. fl. Pyrénées-orientales*, 71 (1898).

PHENOLOGY. Flowering from April to May; fruiting from August to September.

CHROMOSOME NUMBER. $2n = 20$ (Barber, 1941; Stern, 1944; the present work with the voucher: Spain, Avila, D. Y. Hong & P. Vargos H03016 (MO, PE)).

HABITAT AND DISTRIBUTION. Growing in pine woods or in thickets in limestone areas at altitudes from 400 to 2,050 m. Distributed in Portugal, Spain and SW France (Map 5.32).

DIAGNOSTIC CHARACTERS. *Paeonia officinalis* subsp. *microcarpa* is rather distinct from the other four subspecies of *P. officinalis* in having carpels glabrous, or very rarely hirsute. Among 89 flowers examined, only 6 have carpels that are sparsely hirsute and one has moderately hirsute carpels; by contrast carpels in the other four subspecies are all tomentose. Sepals are usually glabrous or sparsely hairy in this subspecies, also contrasting with the others. In addition, the leaflets/leaf segments in this subspecies are generally more numerous than those in the other four subspecies and are often lobed (Fig. 5.32A3). Seeds ellipsoid, black, 7–8 mm long, 5–6 mm wide.

ADDITIONAL SPECIMENS EXAMINED. **FRANCE, Cevennes:** Apr. 1846, *Requien* s.n. (G). **Herault:** near Montpellier, Pic St. Loup, 17 May 1894, *E. Reverchon* s.n. (G); *loc. eodem*, 1891, *Grenia* s.n. (BM); *loc. eodem*, Apr. 1893, *E. Momdou* s.n. (G); *loc. eodem*, 1 May 1887, s. coll. s.n. (RO); *loc. eodem*, 4 May 1887, s. coll. s.n. (RO); *loc. eodem*, 15 Apr. 1873, *E. Ayasse* s.n. (G); Montpellier, *C. Fauconnet* s.n. (G). **Le Vigan:** 19 Apr. 1862, *C. Billot* 3305 (B); *loc. eodem*, 8 May 1877, *L. Anthouard* s.n. (BM) and 7 July 1879, *L. Anthouard* s.n. (BM); *loc. eodem*, limestones, May 1878, *L. Anthouard* s.n. (G); *loc. eodem*, limestones, June 1878, *L. Anthouard* s.n. (G); *loc. eodem*, limestones, 7 June 1876, *Diomete* s.n. (BM); near Pardaihan, St. Martin, 650 m, 25 July 1885, *G. Gautier* s.n. (BM, G). **Pyrenees Or.:** Corbieres, 29 June 1881, *G. Gautier* s.n. (BM, M); near Collioure, *Beyrouth* s.n. (G); Collioure, 42°30'N, 3°E, 18 May 1891, *A. Pellat* s.n. (GZU); near Port-Vendres, 1 June 1837, *P. Bubani* s.n. (G); Fr.-Spain Frontier, Tour Madeloc, 550–650 m, 2 May 2001, *A. Fridlender* H01001 (K, MO, PE); Fr.-Spain Frontier, C. de Banyuls, 360–600 m, 2 May 2001, *A. Fridlender* H01005 (A, K, MO, PE). **PORTUGAL, Beira Alta:** Serra da Estrela, Poço do Inferno, 21 Apr. 1952, *A. Fernandez*, *F. Sousa* & *Y. Matos* 4072 (COI, MA); *loc. eodem*, 1,100 m, in forests, 4 June 1930, *Carriso* & *Mendoça* s.n. (COI). **Beira Baixa:** Serra da Matrata, 3 June 1981, *A. & R. Fernandes* & *A. Matos* 14667 (COI). **Bragança:** Pinelo, between Vimioso and Bragança, 26 Apr. 1962, *Y. Paira*, *Y. Matos* & *A. Margues* 8463 (COI); Bragança, 18 May 1941, *A. de B. Carneiro* 182 (COI). **Guarda:** do Bispo, 17 June 1949, *R. Fernandes* & *F. Sousa* 3461 (COI); *loc. eodem*, 23 Apr. 1952, *A. & R. Fernandes* & *A. Matos* 4141 (COI); between Guarda and Valhelhas, 3 July 1951, *A. Fernandez*, *F. Sousa* & *Y. Matos* 3766 (COI). **SPAIN, Albacete:** Sierra de Alcaraz, 1,500–2,000 m, 25 June 1891, *Porta* & *Rigo* 289 (BM, G, K, WU). **Avila,** Hoyocasero, 4 June 1980, *F. Muñoz* & *E. Valdes-Bermejo*

5600 EV (MA); *loc. eodem*, 22 July 1863, *E. Bourgeau* s.n. (BM); *loc. eodem*, 1,200 m, *Pinus sylvestris* forests, 10 Aug. 2003, *D. Y. Hong & P. Vargos* H03016 (MO, PE); *loc. eodem*, 1,300 m, pine woods, *A. Blanpin & P. A. Lcizeau* AC-22133 (G); 11 km S of Villastin, 1 June 1971, *H. Merxmüller & W. Gleisner* 26638 (M). Vollafronla, Sierra Robledales, 23 June 1974, *G. López & E. Valdes-Bermejo* s.n. (MA). Sierra de Gredos, El Arenal, 1,200 m, pine woods, 24 July 1956, *Deverall & Flanniga* 0408 (E); *loc. eodem*, 1,000 m, 24 July 1956, *Deverall & Flanniga* 0413 (E). **Burgos**, Matorrales, 10 June 1914, *Font Quer* s.n. (BC). San Pantaleon del Pramo, 6 June 1985, *Galan Cela et al.* 1213 (MA). Rebolledo de la Torre, Mte Albacastro, 1,100 m, 10 June 1990, *B. Fz de Betono & J. A. Alejandro* 1217/90 (MA). **Caceres**, Hervás, 11 Apr. 1981, *E. Rico* s.n. (MA). Sierra de Villuercas, Guadalupe,



Fig. 5.32C. *Paeonia officinalis* L. subsp. *microcarpa* (Boiss. & Reut.) Nym.: **a**, a lower leaf; **b**, a flower with petals and stamens shed, showing the disk and two glabrous carpels. Drawn by Miss LI Ai-Li.

18 June 1994, *J. L. Perez Chiscano* s.n. (MA). **Castellon**, Barranc, del Moli Nou, 1,150 m, 11 July 1987, *C. Fabregat* s.n. (MA). **Cuenca**, Alrededores de Solan de Cabras, 13 July 1941, *s. coll.* s.n. (MA). **Granada**, Sierra de Harana, *s. coll.* s.n. (MA); Sierra de Cuarto, 1,800 m, limestones, May 1902, *E. Reverchon* 1273 (B, BM, E, GZU, W). **Guadalajara**, La Alcarria, 13 May 1970, *Bellot & Ron*, s.n. (MA). **Huesca**, Sopeira, 710 m, 10 July 1992, *C. Aedo et al.* C42367 (MA). **Jaen**: Sierra de Segura, 1,750 m, 11 June 1975, *J. Fernandez Piqueras* 319 (MA); 1,800 m, 21 June 1979, *S.*

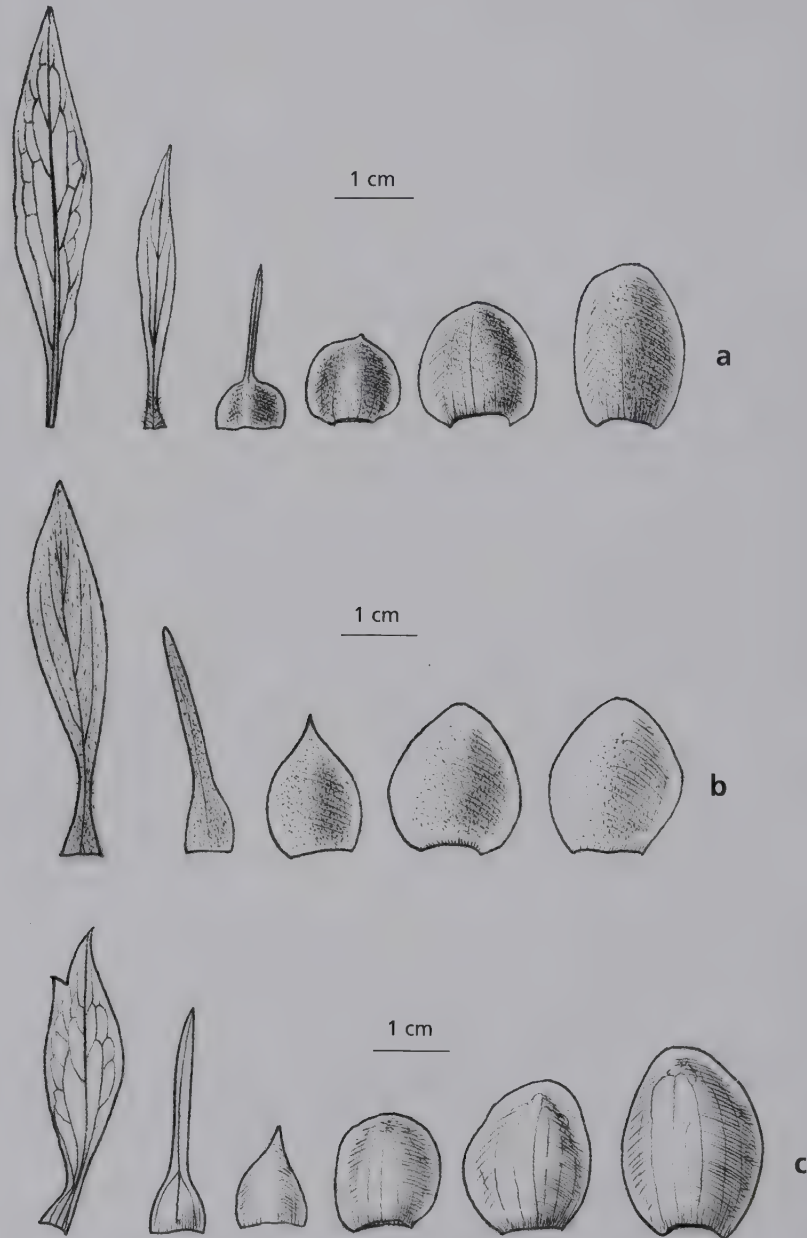


Fig. 5.32D. *Paeonia officinalis* L.: involucrate bracts and sepals. Drawn by Mr SUN Yin-Bao. **a**, subsp. *officinalis*, based on *D. Y. Hong*, *X. Q. Wang & Y. M. Yuan* H01029 (A, BM, CAS, K, MO, PE); **b**, subsp. *huthii*, based on *D. Y. Hong*, *X. Q. Wang & A. Fridlender* H01009 (A, BM, CAS, K, MO, PE); **c**, subsp. *microcarpa*, based on *A. Fridlender* H01001 (MO, PE).

Pajarov et al. 473 (MA); 1,700 m, limestones, June 1906, *E. Reverchon* 1446 (BM, E); Siles, 1,550 m, 23 May 1979, *S. Pajarov & R. Pascual* 326 (MA). Cazorla: Cima de la Cabrilla, 2,030 m, 12 July 1985, *C. Fernandez & J. Cobos*, s.n. (MA); Sierra de la Cabrilla, 10 July 1980, *G. Blanca & F. Valle*, s.n. (MA); Guesada, 1,440 m, 29 May 1976, *Muñoz-Garmendia & Soriano* s.n. (MA). Santiago de la Espada, 1,900 m, 18 June 1976, *G. Rebollar et al.* s.n. (MA). **Leon**, Truches, 1,500 m, 5 July 1978, *E. Temprano* 40 (MA). **Lerida**, Sierra del Cadi, 1,500–1,600 m, 7 Aug. 1987, *J. Pedrol & C. Pedrol* 2249 JP (MA). Mentsac de Rubies, 17 May 1932, *G. Kretschmer* 325 (W). **Madrid**, Rozas de Puetro Real, 1,200 m, 19 Aug. 1986, *F. G. Manzanegue* s.n. (MA). Sierra de Guadarrama, from Nimalka to P. de Navacerrad, 1,300 m, 18 Apr. 1882, *C. C. Lacaita* 975 (BM). **Murcia**, Moratalla, Sierra de la Muelo, 1,250 m, 24 Apr. 1997, *C. Aedo et al.* 1077 IA (MA). **Palencia**: Velilla del Rio Carrión, 1,100 m, 27 May 1991, *C. Aedo et al.* s.n. (MA); Palencia, 1,650 m, 42°57'N, 4°47'W, 21 Aug. 1998, *C. Dobes & E. Vitek* 98-1229 (W). **Salamanca**, Linares de Riofrio, 13 June 1965, *Bellot & Ron* s.n. (MA). **Segovia**, Navares de las Cuevas, 1,350 m, 16 June 1985, *T. Romero* s.n. (MA). **Soria**, Almarza, Sierra de Canredondo, 1,230–1,380 m, 19 May 1990, *M. L. G. Zuniga & J. A. Alejandro* 98/90 (MA). Villaciervos, Sierra de Cabrejas, 11 June 1988, *M. L. G. Zuniga & J. A. Alejandro* 1033/88 (MA). Sierra de Moncayo, Agreda, in forests, 1 June 1933, *L. Ceballos* s.n. (MA). **Tarragona**, Sierra del Montsant, 1,000 m, 18 May 1975, *F. J. Fernandez Casas* 70 (MA). **Tortosa**, Sierra de Caro, 26 June 1917, *M. Gadardo* s.n. (BC). Puertos de Tortosa y Beceite, 980–1,000 m, 11 July 1990, *M. L. G. Znigo & J. A. Alejandro* 576/90 (MA). Sierra de Camarena: 1,600 m, May 1892, *E. Reverchon* s.n. (BM, G, P, W); Sierra de Lardo, 800 m, *s. coll.* s.n. (MA). **Teruel**: Sierra de Javalambre, Torrijas, 22 July 1949, *Mansanet, Borja & Cardona* s.n. (MA); Sierra de Javalambre, 1,000 m, June 1893, *E. Reverchon* s.n. (G). Sierra de Camarena, 1,600 m, May 1892, *E. Reverchon* s.n. (BM, G, P, W); Sierra de Camarena, 1,500 m, limestones, pine forests, June 1892, *E. Reverchon* s.n. (B, E, K, W); *loc. eodem*, Aug. 1892, *E. Reverchon* s.n. (B, E, G, K); *loc. eodem*, 1,500 m, June 1894, *E. Reverchon* s.n. (B, E, M, P); *loc. eodem*, Aug. 1894, *E. Reverchon* s.n. (B, E, P). **Zaragoza**, Tabuenca, Pena las Armas, 1,200 m, 26 May 1973, *A. S. Zubizarreta* 5619 (M, MA); Tabuenca, Sierra de la Nava Alta, 990 m, 10 July 1989, *M. L. G. Zuniga & J. A. Alejandro* 422/89 (MA). Loma Negra, 400 m, 2 May 1988, *J. Pedrol* 2752 JP (MA).

Hybrid nothospecies in PAEONIA L.

(nothospecies 1–5)

1. *Paeonia suffruticosa* Andrews (pro sp.), *Bot. Repos.*, 6: tab. 373 (1804); Rehder, *Man. Cult. Trees and Shrubs*, 214 (1927) (pro sp.); Chen, *Ill. Man. Chin. Trees & Shrubs* edn 1, 261, fig. 193 (1937) and edn 2, 261, fig. 193 (1953) (pro sp.); Stern, *Study Gen. Paeonia*, 40 (1946) (pro sp.), quoad nom.; Fang, *Acta Phytotax. Sin.* 7(4): 313 (1958) (pro sp.), pro parte, excl. syn. *P. decomposita* Hand.-Mazz.; Pan, *Fl. Reip. Pop. Sin.* 27: 41 (1979) (pro sp.), pro parte, excl. syn. *Paeonia decomposita* Hand.-Mazz.; Hong & Pan, *Nordic J. Bot.* 19: 291 (1999) (pro sp.); Hong & Pan, *Acta Phytotax. Sin.* 37(4): 361 (1999) (pro sp.); Hong et al., *Acta Phytotax. Sin.* 42(3): 281 (2004b) (pro sp.); Hong & Pan, *Acta Phytotax. Sin.* 43(2): 169 (2005) (pro sp.); Haw, *The New Plantsman* 8: 166 (2001). TYPE: tab. 373 in Andrews, 1804 (holotype!).

Paeonia arboea Donn, *Hortus Cantabrig.* edn 3, 102 (1804), nom. nud.

Paeonia suffruticosa Andrews var. *purpurea* Andrews, *Bot. Repos.* 7: tab. 448 (1807). TYPE: Andrews' tab. cited (holotype!).

Paeonia moutan Sims, *Bot. Mag.*, 29: tab. 1154 (1808). TYPE: Sims' tab cited (holotype!).

Paeonia frutescens Link, *Enum. Hort. Berol.* 2: 77 (1822), pro syn. sub *P. suffruticosa* Andrews (1804).

Paeonia fruticosa Dum. Cours., *Bot. Cult.* edn 2, 4: 462 (1811).

- Paeonia chinensis* Oken, *Allgemeine Naturgeschichte* 3 (2): 1164 (1841). TYPE: not designated.
- Paeonia yunnanensis* W. P. Fang, *Acta Phytotax. Sin.* 7(4): 318, pl. 61–2 (1958). TYPE: China, Yunnan, Lijiang, “Li-Kiang Hsien, Wen-pe-shan, alt. 2,500 m, shrub 80 cm high, flowers white, slightly reddish, 13 April 1937, T. T. Yu No. 8143” (holotype KUN!).
- Paeonia moutan* Sims var. *anneslei* Sabine, *Trans. Hort. Soc.* 6: 482, cum tab (1826). *Paeonia suffruticosa* Andrews f. *anneslei* (Sabine) Rehder, *J. Arnold Arbor.* 1: 194 (1920). TYPE: Sabine’s tab. cited (holotype!).
- Paeonia papaveracea* Andrews, *Bot. Repos.* 7: tab. 463 (1807). *Paeonia moutan* Sims var. *papaveracea* (Andrews) DC., *Syst. nat.* 1: 387 (1818). *Paeonia suffruticosa* Andrews var. *papaveracea* (Andrews) Kerner, *Hortu Sempervirens, Giant Folio, Stuttgartiae* 40: tab. 473 (1816). TYPE: Andrew’s tab. cited (holotype!).

None of the specimens cited by Stern (1946) under “*P. suffruticosa*” belongs to this taxon; those from Kansu (Gansu), Xizang (Tibet) and Bhutan belong to *Paeonia rockii*, whereas that from Tatsien-lu (Kangding), Sichuan, is an element of *P. decomposita*. Hong (1997a, 1997b) has made it clear that in NW Sichuan (including Kangding) there is only one woody species of *Paeonia*, *P. decomposita*. The plants in S Xizang (Tibet) and Bhutan are *P. rockii* subsp. *atava* (Brühl) D. Y. Hong & K. Y. Pan, which was introduced there, probably from Mt Taibai of Shaanxi Province.

Haw (2001a, 2006) recognised *Paeonia suffruticosa* Andrews as a hybrid, but the cultivated tree peony comprises hundreds of cultivars. The single-flowered tree peonies cultivated for medicinal purpose belong to *P. ostii*. Our molecular data (unpublished) show that traditional tree peonies cultivated for ornament originated from hybridisation between several wild species, and they are thus polyphyletic. Our conclusion is that all the traditional tree peony cultivars grown ornamentally can be grouped under the name, *P. suffruticosa*.

PHENOLOGY. Flowering from middle April to early May; fruiting in August.

CHROMOSOME NUMBER. $2n = 10$ (Li & Zhang, 1982; Sax, 1932; Stebbins, 1938a; Stern, 1944).

NOTES. Flowers double, varying in colour. Only known in cultivation. *P. ×suffruticosa* has been cultivated for more than two thousand years and has hundreds of cultivars.

2. *Paeonia baokangensis* Z. L. Dai & T. Hong (pro sp.), *Bull. Bot. Res. (Harbin)* 17(1): 2, fig. 2 (1997); Hong & Pan, *Nordic J. Bot.* 19: 297 (1999); Haw, *The New Plantman* 8: 167 (2001). TYPE: China, Hubei, Baokang County, Houping Township, 2 May 1996, Z. L. Dai, D. Y. Ran & Q. D. Li 96047 (holotype China, Hubei Prov., Baokang Forestry Research Institute!; photo PE!).

Morphologically, *Paeonia baokangensis* is intermediate between *P. qiui* and *P. rockii* subsp. *rockii*, and thus it is believed to be a hybrid of these two species. The shrub from which the type was collected was growing at the side of Mr QI Xin-Hua’s house in Hongjiayuan Village. The two putative hybrid parents occur on nearby mountains, and villagers liked to grow them in their yards (see Hong & Pan, 1999a for detail).

3. *Paeonia yananensis* T. Hong & M. R. Li (pro sp.), *Bull. Bot. Res. (Harbin)* 12(3): 226, fig. 3 (1992). *Paeonia suffruticosa* Andrews subsp. *rockii* S. G. Haw & Lauener var. *yananensis* (T. Hong & M. R. Li) Halda, *Acta Mus. Richnov. Sect. Nat.* 4(2): 30 (1997). TYPE: China, Shaanxi, Yan’an, Wanhua Shan, in *Platycladus orientalis* forests, 5 May 1994, D. Y. Hong, K. Y. Pan & H. C. Zheng 94009 (neotype here designated, PE!; isoneotype PE!).

We have visited the herbarium CAF, but the curator could not be able to find “the type T. Hong 915013”. The senior author, T. Hong, subsequently told us that he failed to preserve the type.

Paeonia yananensis is morphologically intermediate between *P. rockii* subsp. *atava* and *P. jishanensis*, which are considered the two putative parents of the hybrid (see Hong & Pan, 1999a for detail). This consideration has been confirmed by sequencing of the single-copy nuclear gene *GPAT* (Zhou *et al.*, unpublished).

ADDITIONAL SPECIMENS EXAMINED. CHINA, SHAANXI, Yan'an: Mt Wanhushan, in the valley of E side, *Platycladus orientalis* forests, 5 May 1994, D. Y. Hong, K. Y. Pan & H. C. Zheng 94011 (PE); *loc. eodem*, in cultivation, 9 May 1997, D. Y. Hong & Y. X. Feng H97068 (PE); Wanhua Township, Wangjiagou Village, in waste fields, 5 May 1994, D. Y. Hong, K. Y. Pan & H. C. Zheng 94008 (PE).

4. *Paeonia lemoinei* Rehder, *J. Arnold Arb.* 1: 194 (1920); Haw, *The New Plantsman* 8: 170 (2001). TYPE: plate in *Gard. Chron.* ser. 3, 57: supplementary plate (1915) (lectotype designated by Haw, 2001a: 170).

Paeonia saundersii Haworth-Booth, *The Moutan or Tree Peony*, 30 (1963), as “saundersi”, nom. nud.

Paeonia lemoinei is an intersubsectional hybrid between *P. delavayi* (subsect. *Delavayanae*) with yellow flowers and *P. suffruticosa* (subsect. *Vaginatae*). The cross was first made by the French nursery company Lemoine et fils in about 1900. This hybrid is only known to exist in cultivation.

5. *Paeonia* × *saundersii* Stebbins (*P. tenuifolia* × *P. daurica*), *Univ. Calif. Publ. Bot.* 19: 257, fig. 9 (1939). TYPE: fig. 9 in Stebbins, 1939 (lectotype here designated!).

Paeonia majko Ketsk., *Notul. Syst. Geograph. Inst. Bot. Tiflis.* 21: 17, figs 1, 4 (1959). TYPE: Georgia, Kartly, near Igoeti, “Carthli, prope P. Igoithi, declive septentrionale in quercetocarpinetum”, 4 May 1959, *N. Ketskovieli* s.n. (holotype TBI!).

Paeonia intermedia auct. non C. A. Mey.: Hong & Zhou, *J. Linn. Soc. Bot.* 143: 143 (2003), pro parte, quoad pl. Georg.

In 1999, we visited the type locality of *Paeonia majko* in Kartly of Georgia and examined the type specimen of *P. majko*. A natural population was found in a deciduous forest dominated by *Quercus*, *Fagus*, *Acer*, and *Carpinus* between two villages, Lamistskali and Igoeti. *Paeonia daurica* subsp. *coriifolia* also grew in the forest, and a population of *P. tenuifolia* was found in a meadow with shrubs only 200 m in the distance. It is similar to *P. intermedia* in appearance, but our molecular data of *Paeonia* sect. *Paeonia* imply that the population in Georgia is a hybrid between *P. tenuifolia* and *P. daurica* subsp. *coriifolia*. Morphologically, *P. majko* with over 100 leaflets/leaf segments is distinct from *P. daurica* subsp. *coriifolia* with nine leaflets. A molecular tree of sect. *Paeonia* based on sequences of cpDNA *matK* and *rps16-trnQ* indicates that *P. tenuifolia* functioned as the maternal parent in forming the hybrid (J. Pan, 2006).

Another natural population of this hybrid was reported by Maleev from Crimea, Ukraine, where the two parental species coexisted (cf. Stebbins, 1939).

ADDITIONAL SPECIMENS EXAMINED. GEORGIA, Kartly: between Lamistskali and Igoeti, 630 m, in deciduous forests, 2 May 1999, D. Y. Hong & S. L. Zhou H99033 (PE); *loc. eodem*, 15 May 1958, *N. Ketskovieli* s.n. (TBI); *loc. eodem*, 3 Apr. 1960, Sanadze *et al.* s.n. (TBI); *loc. eodem*, 5 May 1964, *N. Ketskovieli* s.n. (TBI).

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INDEX TO BOTANICAL NAMES IN PAEONIA

Recognised names appear in **bold**; infraspecific taxa of cultivated peonies are generally not included.

Paeonia L. (1753)

A. Superspecific names and synonyms

Subgenera

- subg. *Albiflora* (Salm-Dyck) Halda (1998) (= sect. *Paeonia* subsect. *Albiflorae*) 20, 21, 22, 56
- subg. *Moutan* (DC.) Ser. (1849) (= sect. *Moutan*) 2, 13, 14, 20, 22
- subg. *Onaepia* (Lindl.) Lynch (1890) (= sect. *Onaepia*) 14, 20, 22
- subg. *Paeon* (DC.) Ser. (1849) (= sect. *Paeonia*) 13, 55
- subg. *Paeonia* Baker (1884), pro parte, excl. *P. brownii* (= sect. *Paeonia*) 14, 20, 22, 55, 56

Sections

- sect. *Albiflorae* Salm-Dyck (1834) (= sect. *Paeonia* subsect. *Albiflorae*) 13, 19, 21, 22, 56
- sect. *Compactae* Salm-Dyck (1834) (= sect. *Paeonia*) 13, 22, 53, 58
- sect. *Corallinae* Salm-Dyck (1834) (= sect. *Paeonia*) 13, 22, 57
- sect. *Delavayanae* (Stern) Halda (1997) (= sect. *Moutan* subsect. *Dalavayanae*) 20, 52
- sect. *Emodi* Halda (1998) (= sect. *Paeonia* subsect. *Albiflorae*) 20, 56, 57
- sect. *Eupaeonia* Baillon (1863) (= sect. *Paeonia*) 53
- sect. *Flavonia* Kem.-Nath. (1961), pro parte, excl. ser. *Luteae* (= sect. *Paeonia*) 21, 22, 54, 56, 57
- sect. *Laciniatae* Salm-Dyck (1834) (= sect. *Paeonia*) 13, 22, 58
- sect. *Lobatae* Salm-Dyck (1834) (= sect. *Paeonia*) 13, 22, 58
- sect. *Macrocarpae* Salm-Dyck (1834) (= sect. *Paeonia*) 13, 22
- sect. *Microcarpae* Salm-Dyck (1834) (= sect. *Paeonia*) 13, 22, 58
- sect. ***Moutan*** DC. (1824) 2, 8, 9, 12, 13, 17, 19, 20, 22, 29, 31, 34, 36, 37, 39, 41, 44, 49, **50**, 51, 61, 70, 74, 90
- sect. *Moutan* sensu Halda (1997, 2004) (= *Paeonia* sect. *Moutan* subsect. *Vaginatae*) 52
- sect. *Moutania* Rchb. (1841) (= sect. *Moutan*)
- sect. *Mutan* Asch. & Graebn. (1923) (= sect. *Moutan*)
- sect. *Nearcticae* Huth (1891) (= sect. *Onaepia*) 15, 22, 53
- sect. ***Onaepia*** Lindl. (1839) 5, 9, 17, 19, 22, 29, 31, 37, 44, 49, **53**, 54, 97, 98
- sect. *Paeon* DC. (1824) (= sect. *Paeonia*) 12, 13, 17, 21, 22, 23, 56, 57
- sect. ***Paeonia*** 9, 12, 13, 17, 19, 20, 22, 29, 31, 33, 36, 37, 39, 41, 49, **53**, 55, 56, 57, 58, 110, 137, 202, 203, 224, 243
- sect. *Palaearticae* Huth (1891) (= sect. *Paeonia* + sect. *Moutan*) 15, 16, 19, 21, 22, 53, 54
- sect. *Palaearticae* Huth emend. M. S. Uspensk. (1987) (= sect. *Paeonia*) 21, 22
- sect. *Sternia* Kem.-Nath. (1961) (= sect. *Paeonia* subsect. *Paeonia*) 21, 22, 54, 56, 58
- sect. *Suffruticosae* Salm-Dyck (1834) (= sect. *Moutan*) 13, 22, 51
- sect. *Tripaonia* Baillon (1863) (= sect. *Paeonia*) 53
- sect. *Tenuifoliae* (Stern ex M. S. Uspensk.) Halda (1998) (= sect. *Paeonia* subsect. *Paeonia*) 20, 56, 58

Subsections

- subject. **Albiflorae** (Salm-Dyck) D. Y. Hong 56, 57, 58, 110
 subject. *Anomalae* (Kem.-Nath. ex M. S. Uspensk.) Halda (1997) (= sect. *Paeonia* subsect *Albiflorae* 56, 57
 subject. **Delavayanae** Stern (1946) 9, 17, 19, 23, 44, 51, 52, 61, 74, 243
 subject. *Dissectifoliae* Stern (1946), pro parte, excl. *P. clusii*, *P. anomala*, & *P. veitchii* (= sect. *Paeonia* subsect. *Paeonia*) 17, 23, 58
 subject. *Flavonia* (Kem.-Nath.) Halda (1997) (= sect. *Paeonia*) 54
 subject. *Flavonia* (Kem.-Nath.) M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 18, 19, 57
 subject. **Foliolatae** Stern (1946) 17, 23, 56, 57, 58, 137
 subject. *Foliolatae* (Stern) Halda (1997) (= sect. *Paeonia* subsect. *Foliolatae*)
 subject. *Foliolatae* (Stern) M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 19
 subject. *Fruticosae* Huth (1891) (= sect. *Moutan*) 15, 16
 subject. *Herbaceae* Huth (1891) (= sect. *Paeonia*) 15, 16, 53
 subject. *Masculae* (M. S. Uspensk.) Halda (2004) (= sect. *Paeonia* subsect. *Foliolatae*) 20, 56, 57
 subject. *Obovatae* (Kom. ex Schipcz.) Halda (2004) (= sect. *Paeonia* subsect. *Foliolatae*) 56
 subject. *Obovatae* (Kom. ex Schipcz.) Halda (1997) (= sect. *Paeonia* subsect. *Foliolatae*)
 subject. *Obovatae* (Kom. ex Schipcz.) M.S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 19, 57
 subject. **Paeonia** 20, 56, 58, 59, 203
 subject. *Tenuifoliae* (Stern ex M. S. Uspensk.) Halda (1997) (= sect. *Paeonia* subsect. *Paeonia*)
 subject. **Vaginatae** Stern (1946) 9, 17, 19, 23, 44, 51, 52, 243
 Series
 ser. *Anomalae* Kem.-Nath. ex M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Albiflorae*) 19, 57
 ser. *Arietinae* Stern ex M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 19, 57
 ser. *Chinensis* Kom. ex Schipcz. (1937) (= sect. *Paeonia* subsect. *Albiflorae*) 16, 57
 ser. *Corallinae* Kom. ex Schipcz. (1937) (= sect. *Paeonia* subsect. *Foliolatae*) 16, 57
 ser. *Delavayanae* Kem.-Nath. (1961) (= sect. *Moutan* subsect *Delavayanae*) 52, 56
 ser. *Dentatae* Kom. ex Schipcz. (1937), pro parte, excl. *P. hybrida* (= sect. *Paeonia* subsect. *Albiflorae*) 16, 57
 ser. *Fissae* Kom. ex Schipcz. (1937) (= sect. *Paeonia* subsect. *Paeonia*) 16, 58
 ser. *Macrophyllae* (Kem.-Nath.) M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 19, 57
 ser. *Masculae* Stern ex M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 19, 57
 ser. *Obovatae* Kom. ex Schipcz. (1937) (= sect. *Paeonia* subsect. *Foliolatae*) 16, 57
 ser. *Officinalis* Kem.-Nath. ex M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Paeonia*) 19
 ser. *Tenuifoliae* Stern ex M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Paeonia*) 19, 58
 ser. *Wittmannianae* (Stern ex Kem.-Nath.) M. S. Uspensk. (1987) (= sect. *Paeonia* subsect. *Foliolatae*) 19, 58

B. Specific or infraspecific names and synonyms

- abchastica* Misch. ex Grossh. (1930) (= *P. daurica* subsp. *wittmanniana*) 16, 25, 179
albiflora Pall. (1788) (= *P. lactiflora*) 11, 13, 16, 24, 53, 56, 57, 110, 111
 var. *edulis* (Salisb.) Pursh (1815) (= *P. lactiflora*) 11, 110
 var. *fragrans* Sabine (1817) (= *P. lactiflora*) 110
 var. *hirta* Regel (1861) (= *P. lactiflora*) 110
 var. *humei* Sabine (1817) (= *P. lactiflora*) 110
 var. *purpurea* Korsh. (1892) (= *P. lactiflora*) 110

- var. *spontanea* Makino (1928) (= *P. lactiflora*) 110
var. *trichocarpa* Bunge (1831) (= *P. lactiflora*) 36, 37, 110, 111
var. *trichocarpa* f. *nuda* Nakai (1937) (= *P. lactiflora*) 110
var. *trichocarpa* f. *pilosella* Nakai (1937) (= *P. lactiflora*) 110
var. *typica* Huth f. *genuina* Schipcz. (1921) (= *P. lactiflora*) 110
var. *typica* Huth f. *pilifera* Schipcz. (1921) (= *P. lactiflora*) 110
var. *whitleyi* Sabine (1817) (= *P. lactiflora*) 110
- algeriensis** Chabert (1889) 6, 14, 26, 35, 45, 47, 55, 58, 60, 181, 182, 198, **200**, 201, 202
altaica K. M. Dai & T. H. Ying (1990) (= *P. anomala* subsp. *anomala*) 10, 19, 41, 127
anemoniflora (Hook.) Hort. (1887) (= *P. officinalis* subsp. *huthii*) 235
angustiloba (Rehder & E. H. Wilson) Stapf ex Stern (1946), pro syn. sub *P. potaninii* (= *P. delavayi*) 66
anomala L. (1771) 10, 11, 12, 14, 15, 16, 17, 18, 19, 21, 23, 24, 25, 27, 29, 31, 35, 39, 41, 55, 56
57, 59, 119, 121, **125**, 126, 127, 128, 205
subsp. **anomala** 10, 41, 49, 126, **127**, 133
subsp. **veitchii** (Lynch) D. Y. Hong & K. Y. Pan (2001) 9, 10, 14, 17, 19, 23, 39, 40, 41, 56,
126, **132**, 133, 134
subsp. *hybrida* Halda (2004) (= *P. intermedia*) 203
subsp. *intermedia* (C. A. Mey.) Trautv. (1904) (= *P. intermedia*) 23, 203
subsp. *pamiroalaica* (Ovcz.) R. Cooper (1988) (= *P. intermedia*) 203
var. *angustifolia* Krasnob. (1974) (= *P. anomala* subsp. *anomala*) 127
var. *emodi* (Wall. ex Royle) Huth (1891) (= *P. emodi*) 118
var. *hybrida* Trautv. (1860), non Pallas (= *P. intermedia*) 203
var. *hybrida* (Pall.) Trautv. f. *intermedia* (C. A. Mey.) Trautv. (1860) (= *P. intermedia*) 23, 203,
205
var. *insignis* Lynch (1890) (= *P. anomala* subsp. *anomala*) 127
var. *intermedia* (C. A. Mey.) B. Fedtsch. (1905) (= *P. intermedia*) 23, 24, 203, 205
var. *nudicarpa* Huth (1891) (= *P. anomala* subsp. *anomala*) 127
var. *typica* Regel (1861) (= *P. anomala* subsp. *anomala*) 127
- arborea* Donn (1804), nom. nud., sub *P. suffruticosa*) 11, 13
arietina G. Anderson (1818) 4, 5, 12, 14, 21, 25, 26, 27, 29, 31, 35, 37, 43, 55, 56, 57, 58, 59,
164, 165, 181, 182, 215, 220, **221**, 223, 224, 225, 228
var. *andersonii* G. Anderson (1818) (= *P. arietina*) 221
var. *carnea* DC. (1824) (= *P. clusii*) 164
var. *orientalis* (Thiébaut) Stern (1940) (= *P. mascula* subsp. *mascula*) 183
var. *oxoniensis* G. Anderson (1818) (= *P. clusii*) 164
- atlantica* Trab. (1889), nom. nud. (= *P. algeriensis*) 200
bakeri Lynch (1890) (= *P. arietina*) 10, 14, 221
banatica Rochel (1828) (= *P. officinalis* subsp. *banatica*) 5, 12, 15, 23, 57, 181, 224, 233
baokangensis Z. L. Dai & T. Hong (1997) (= *x P. baokangensis*) 1, 20, **242**
barrii Lynch (1890) (= *P. officinalis*) 10, 14, 228
baxteri Sabine ex Salm-Dyck (1834), nom. nud., pro syn. sub *P. peregrina* (= *P. peregrina*) 228
beresowskii Kom. (1921) (= *P. anomala* subsp. *veitchii*) 15, 127, 132
biebersteiniana Rupr. (1869) (= *P. tenuifolia*) 3, 14, 16, 25, 208, 211
bifurcata Schipcz. (1920) (= *P. mairei*) 15, 191
broteri Boiss. & Reut. (1842), nom. cons. 5, 7, 9, 11, 13, 14, 15, 23, 24, 25, 26, 29, 35, 36, 37,
55, 58, 59, 60, **159**, 160, 161, 165
var. *ovatifolia* Boiss. & Reut. (1842) (= *P. broteri*) 157
brownii Douglas ex Hook. (1829) 5, 6, 12, 13, 14, 16, 17, 20, 27, 37, 39, 41, 42, 53, 55, **97**, 98,
99, 100, 102, 104, 105

- subsp. *californica* (Nutt. ex Torr. & A. Gray) Halda (1997) (= *P. californica*) 103
 var. *californica* (Nutt. ex Torr. & A. Gray) Lynch (1890) (= *P. californica*) 13, 103
byzantina DC. (1824), pro syn. sub *P. decora* (= *P. peregrina*) 215
californica Nutt. ex Torr. & A. Gray (1838) 5, 6, 13, 14, 16, 17, 26, 27, 30, 33, 37, 39, 41, 49, 53, 55, 103, 104, 105, 106, 107
cambessedesii (Willk.) Willk. (1880) 13, 14, 15, 17, 24, 25, 26, 27, 31, 32, 33, 35, 37, 42, 45, 49, 55, 58, 60, **149**, 150, 151, 154, 156, 196
carthalinica Ketsk. (1959) (= *P. tenuifolia*) 3, 18, 208, 211
cathayana D. Y. Hong & K. Y. Pan (2007) 9, 34, 44, 51, 52, 53, 92, **94**, 95, 96, 97
caucasica Schipcz. (1937) (= *P. daurica* subsp. *coriifolia*) 16, 25, 173
 var. *coriifolia* (Rupr.) Schipcz. (1937) (= *P. daurica* subsp. *coriifolia*) 173
chinensis Oken (1841) (= *P. suffruticosa*) 241
chinensis Hort ex Vilm. (1870) (= *P. lactiflora*) 110
clusii Stern (1940) 17, 18, 19, 23, 27, 35, 37, 43, 55, 56, 59, 160, **164**, 165, 166, 167, 224
 subsp. *clusii* **165**
 subsp. *rhodia* (Stearn) Tzanoud. (1977) 17, 19, 165, **167**
commutata Wender. (1829) (= *P. officinalis*) 229
corallina Retz. (1783) (= *P. mascula*) 11, 14, 15, 24, 25, 26, 55, 181, 202
 subsp. *atlantica* (Coss.) Maire (1964) (= *P. algeriensis*) 202
 subsp. *coriacea* (Boiss.) Maire (1932) (= *P. coriacea*) 197
 var. *maroccana* Pau & Font Quer ex Maire (1932) (= *P. coriacea*) 197
 subsp. *triternata* (Pall. ex DC.) N. Busch (1901) (= *P. daurica* subsp. *coriifolia*) 168
 var. *coriifolia* (Rupr.) N. Busch (1901) (= *P. daurica* subsp. *coriifolia*) 173
 var. *atlantica* Coss. (1887) (= *P. algeriensis*) 182, 200
 var. *broteri* (Boiss. & Reut.) Coss. (1887) (= *P. broteri*) 159
 var. *broteri* Boiss. & Reut. 153, 159
 f. *ovatifolia* (Boiss. & Reut.) Asch. & Graebn. (1923) (= *P. broteri* + *P. corsica*) 153, 160
 var. *broteri* auct. non Boiss. & Reut.: Ascherson & Graebner (1923) pro parte, excl. pl. Cors. (= *P. mascula* subsp. *russoi*) 189
 var. *cambessedesii* Willk. (1875) (= *P. cambessedesii*) 12, 25, 149, 154
 var. *cambessedesii* auct. non Willk.: Huth (1891), pro parte, quoad pl. Cors. (= *P. corsica*) 153
 var. *caucasica* Schipcz. (1921) (= *P. daurica* subsp. *coriifolia*) 16, 173
 var. *coriacea* (Boiss.) Coss. (1887) (= *P. coriacea*) 197
 var. *coriifolia* (Rupr.) Grossh. (1930) (= *P. daurica* subsp. *coriifolia*) 173
 var. *corsica* (Sieber ex Tausch) Coss. (1887) (= *P. corsica*) 152, 154
 var. *flavescens* (C. Presl) Guss. (1843) (= *P. mascula* subsp. *russoi*) 188
 var. *fructibus glabris* Cambess. (1827) (= *P. cambessedesii*) 12, 149
 var. *kesrouanensis* Thiébaud (1934) (= *P. kesrouanensis*) 16, 193
 var. *leiocarpa* Coss. (1850) (= *P. corsica*) 153, 154
 var. *orientalis* Thiébaud (1936) (= *P. mascula* subsp. *mascula*) 183
 var. *pallasi* Huth (1891) (= *P. daurica*) 25, 168
 var. *pubescens* Moris (1837) (= *P. corsica*) 153, 157
 f. *hypoleuca* Briq. (1910) (= *P. corsica*) 153, 157
 var. *russoi* auct. non Biv.: Webb (1838) (= *P. coriacea*) 152
 var. *russoi* (Biv.) Coss. (1887) (= *P. corsica*) 153, 154, 188, 197
 f. *hypoleuca* (Briquet) Asch. & Graebn. (1923), pro parte, quoad pl. Cors. & Sardin. (= *P. corsica*) 153
 var. *triternata* Boiss. (1867) (= *P. daurica* subsp. *daurica*) 168, 177
 var. *triternatiformis* A. Nyár. (1953) (= *P. daurica* subsp. *daurica*) 171

- var. *wittmanniana* (Steven) Albov (1895) (= *P. daurica* subsp. *wittmanniana* and subsp. *macrophylla*) 174, 179
- f. *macrophylla* Albov 174
- f. *corsica* (Sieber ex Tausch) Rouy & Foucaud (1893) (= *P. corsica*) 152, 154
- f. *ovatifolia* (Boiss. & Reut.) Rouy & Foucaud (1893) (= *P. mascula* subsp. *russoi*) 153, 157, 188
- f. *russoi* (Biv.) Rouy & Foucaud (1893) (= *P. mascula* subsp. *russoi*) 153
- f. *triternata* (Pall. ex DC.) Rouy & Foucaud (1893) (= *P. daurica*) 153, 157, 168
- corallina* auct. non Retz.: Amo y Mora (1873) (= *P. cambessedesii*) 149
- coriacea** Boiss. (1838) 9, 13, 14, 15, 22, 24, 26, 27, 37, 47, 55, 58, 60, 154, 156, 160, 183, 195, 196, **197**, 198, 199, 200, 202
- coriacea* auct. non Boiss.: Zángheri (1976), pro parte, quoad pl. Cors. & Sardin. (= *P. corsica* Sieber ex Tausch) 153
- var. *atlantica* (Coss.) Stern (1943) (= *P. algeriensis*) 181, 182, 202
- var. *maroccana* (Pau & Font Quer ex Maire) Romo (1992) (= *P. coriacea*) 197
- corsica** Sieber ex Tausch (1828) 5, 12, 14, 15, 24, 25, 26, 27, 31, 33, 35, 36, 37, 38, 39, 45, 46, 55, 58, 60, **152**, 154, 155, 156, 181, 183, 189, 198, 202
- cretica* Clus. ex DC. (1818), non pro sp. accept., sub *P. clusii* 164
- cretica* Sabine ex Lindl. (1824) (= *P. arietina*) 12, 17, 164, 165, 221
- cretica* Tausch (1828) (= *P. clusii*) 12, 17, 164
- daurica** Andrews (1807c) 3, 4, 9, 11, 14, 15, 16, 18, 25, 26, 27, 33, 34, 36, 43, 46, 55, 57, 58, 60, **168**, 169, 170, 175, 178, 182, 195
- subsp. *coriifolia* (Rupr.) D. Y. Hong (2003) 18, 170, **173**, 243
- subsp. *daurica* 32, **171**, 170, 172, 176
- subsp. *macrophylla* (Albov) D. Y. Hong (2003) 13, 18, 21, 57, 170, **174**
- subsp. *mlokosewitschii* (Lomakin) D. Y. Hong (2003) 18, 35, 36, 43, 56, 170, **176**, 224
- subsp. *tomentosa* (Lomakin) D. Y. Hong (2003) 35, 170, **176**
- subsp. *velebitensis* D. Y. Hong, subsp. nov. 35, 170, **178**
- subsp. *wittmanniana* (Hartwiss ex Lindl.) D. Y. Hong (2003) 54, 58, 170, **179**
- decomposita** Hand.-Mazz. (1939) 1, 16, 18, 23, 33, 37, 44, 49, 51, 52, 53, **74**, 75, 76, 241, 242
- subsp. *decomposita* **75**, 77, 78
- subsp. *rotundiloba* D. Y. Hong (1997b) **75**, 77
- decora* G. Anderson (1818) (= *P. peregrina*) 12, 13, 14, 15, 24, 25, 213, 215
- var. *elatior* G. Anderson (1818) (= *P. peregrina*) 213
- var. *pallasii* G. Anderson (1818) (= *P. peregrina*) 213
- delavayi** Franch. (1886) 1, 3, 8, 9, 14, 15, 16, 19, 21, 22, 23, 27, 29, 30, 31, 33, 35, 37, 41, 43, 44, 45, 49, 51, 52, 53, 62, 64, **66**, 67, 68, 69, 70, 71, 75, 243
- var. *alba* Bean (1933) (= *P. delavayi*) 41, 43, 66
- var. *angustiloba* Rehder & E. H. Wilson (1913) (= *P. delavayi*) 66
- var. *atropurpurea* Schipcz. (1921) (= *P. delavayi*) 41, 43, 66
- var. *lutea* (Delavay ex Franch.) Finet & Gagnep. (1904) (= *P. delavayi*) 66, 71
- var. *lutea* f. *superba* Lemoine (1906) (= *P. delavayi*) 66
- edulis* Salisb. (1805) (= *P. lactiflora*) 11, 110
- var. *reevesiana* Paxton (1834) (= *P. lactiflora*) 111
- var. *sinensis* Sims (1815) (= *P. lactiflora*) 111
- elegans* Sabine ex Salm-Dyck (1834), pro syn. sub *P. officinalis* (= *P. officinalis*) 228
- emodi** Wall. ex Royle (1834) 6, 14, 16, 17, 25, 27, 35, 39, 41, 43, 55, 56, 57, 59, 111, **118**, 119, 120, 121, 122, 124
- subsp. *sterniana* (H. R. Fletcher) Halda (1997) (= *P. sterniana*) 18
- var. *glabrata* Hook. f. & Thomson (1875) (= *P. emodi*) 118

- f. glabrata* (Hook. f. & Thomson) H. Hara (1979) (= *P. emodi*) 118
feminea (L.) Desf. (1804) (= *P. officinalis*) 11, 229
 var. *banatica* (Rochel) Gürke (1903) (= *P. officinalis* subsp. *banatica*) 233
 var. *cretica* (Tausch) Gürke (1903), pro parte, quoad pl. *Cret.* (= *P. clusii*) 164
 var. *humilis* (Retz.) Gürke (1903) (= *P. officinalis* subsp. *microcarpa*) 237
 var. *villosa* (Desf.) Gürke (1903), pro parte, quoad syn. *villosa* (= *P. officinalis* subsp. *huthii*) 235
festiva Tausch (1828) (= *P. officinalis*) 12, 229
flagrans Redouté (1827), err., pro *P. fragrans* (= *P. lactiflora*) 111
flavescens C. Presl (1822) (= *P. mascula* subsp. *russoi*) 15, 188
foemina Garsault (1764) (= *P. officinalis*) 228
foeminea Mill. (1768) (= *P. officinalis*) 228
foeminea Mill. var. *cretica* (Tausch) Gürke (1903) (= *P. clusii*) 164
forrestii var. *trollioides* (Stapf ex Stern) Saunders (1934) (= *P. delavayi*) 66
fragrans (Sabine) Redouté (1827) (= *P. lactiflora*) 12, 110
frutescens Link (1822), pro syn. sub *P. moutan* (= *P. suffruticosa*) 241
fruticosa Dum. Cours. (1811) (= *P. suffruticosa*) 241
glabrescens Jord. (1903) (= *P. corsica*) 15, 152, 157
hartwissiana Hort ex Trautv. (1883), nom. nud. (= *P. daurica* subsp. *macrophylla*) 175
hirsuta Mill. (1768) (= *P. officinalis* subsp. *officinalis*) 11, 12, 229
hirsuta auct. non Mill., sensu J. St.-Hil. (1809) (= *P. officinalis* var. *huthii*) 236
humei (Sabine) Vilm. (1870), pro syn. sub *P. albiflora* (= *P. lactiflora*) 110
humilis Retz. (1783) (= *P. officinalis* subsp. *microcarpa*) 11, 13, 15, 22, 23, 224, 237
 var. *gallica* Salm-Dyck (1834) (= *P. officinalis* subsp. *microcarpa*) 13, 238
 var. *villosa* (Huth) Stern (1943) (= *P. officinalis* subsp. *huthii* and *P. officinalis* subsp. *italica*) 235, 237
hybrida Pall. (1788) (= *P. tenuifolia*) 11, 12, 14, 16, 18, 24, 25, 26, 29, 57, 126, 205, 208
 var. *intermedia* (C. A. Mey.) Krylov (1901) (= *P. intermedia*) 23, 203
hybrida auct. non Pall.: C. A. Meyer (1830) (= *P. intermedia*) 203
integra J. A. Murray (1786) (= *P. mascula*) 181
integrifolia Link (1822), err., pro *P. integra* J. A. Murray (= *P. mascula*) 181
intermedia C. A. Mey. (1830) 12, 14, 23, 25, 26, 27, 29, 30, 35, 41, 55, 56, 58, 126, 127, **203**, 204, 205, 243
 subsp. *pamiroalaica* Ovcz. (1975) (= *P. intermedia*) 203
japonica (Makino) Miyabe & Takeda (1910) (= *P. obovata*) 2, 16, 17, 25, 26, 41, 44, 137, 138
 var. *pilosa* Nakai (1937) (= *P. obovata*) 137
 var. *typica* Nakai (1937) (= *P. obovata* subsp. *obovata*) 138
jishanensis T. Hong & W. Z. Zhao (1992) 9, 10, 19, 20, 26, 34, 37, 39, 43, 44, 51, 52, 53, 79, **87**, 88, 89, 90, 91, 92, 243
kansuensis W. T. Wang & S. H. Wang in sched. (PE) (= *P. rockii* subsp. *rockii*) 79
kavachensis Azn. (1917) (= *P. mascula* subsp. *mascula*) 16, 183
 var. *coriifolia* (Rupr.) Grossh. (1950) (= *P. daurica* subsp. *coriifolia*) 173
kesrouanensis (Thiébaud) Thiébaud (1936) 4, 5, 9, 13, 16, 18, 26, 27, 29, 31, 37, 46, 55, 58, 60, 181, 182, 183, **193**, 194, 195, 196
kurdistanica Zohary (1941) (= *P. mascula* subsp. *mascula*) 183
laciniata Pall. (1788) (= *P. anomala*) 11, 14, 125, 126
lactea Pall. (1776), nom. nud., sub *P. lactiflora* 110
lactiflora Pall. (1776) 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 24, 27, 30, 32, 35, 36, 37, 39, 41, 45, 46, 53, 55, 56, 57, 58, **110**, 111, 112, 115, 119
 var. *trichocarpa* (Bunge) Stern (1943) (= *P. lactiflora*) 26, 37, 39

- var. *villosa* M. S. Yan & K. Sun (1992) (= *P. lactiflora*) 110
 f. *nuda* (Nakai) Kitag. (1979) (= *P. lactiflora*) 110
 f. *pilosella* (Nakai) Kitag. (1979) (= *P. lactiflora*) 110
lagodechiana Kem.-Nath. (1961) (= *P. daurica* subsp. *mlokosewitschii*) 18, 25, 26, 43, 57, 176
lanceolata Salm-Dyck (1834) (= *P. officinalis*) 13, 228
leiocarpa Jord. (1903) (= *P. officinalis* subsp. *microcarpa*) 15, 36, 238
linyanshanii (S. G. Haw & Lauener) B. A. Shen (2001), nom. illeg. (= *P. rockii*) 79
 subsp. *taibaishanica* (D. Y. Hong) B. A. Shen (2001), nom. illeg. (= *P. rockii* subsp. *atava*) 82
lithophila Kotov (1956) (= *P. tenuifolia* Pall. (1776), nom. nud. (= *P. anomala*) 18, 208, 211, 212
lobata auct. non Desf. ex DC., sensu Rchb. (1840) (= *P. officinalis*) 13, 229
lobata Desf. (1804), nom. nud. (= *P. broteri*) 11, 13, 160
lobata Desf. ex DC. (1818), pro parte (= *P. broteri* and *P. peregrina*) 12, 160, 213
lobata Desf. ex Boiss. (1839) (= *P. broteri*) 160
ludlowii (Stern & G. Taylor) D. Y. Hong (1997) 1, 9, 17, 26, 31, 35, 37, 41, 42, 43, 44, 45, 47, 51, **61**, 62, 63, 64, 65, 70, 75
ludlowii (Stern & G. Taylor) J. J. Li & D. Z. Chen (1998) (= *P. ludlowii* (Stern & G. Taylor) D. Y. Hong (1997) 61
lusitanica Mill. (1768), nom. rej. (= *P. broteri* Boiss. & Reut. (1842), nom. cons.) 5, 7, 11, 12, 13, 14, 24, 29, 159
 var. *ovatifolia* (Boiss. & Reut.) Samp. (1913) (= *P. broteri*) 160
lutea Delavay ex Franch. (1886) (= *P. delavayi*) 1, 8, 9, 14, 15, 16, 19, 21, 23, 26, 41, 43, 53, 66, 70
 subsp. *ludlowii* (Stern & G. Taylor) Halda (1999) (= *P. ludlowii*) 61
 var. *ludlowii* Stern & G. Taylor (1951) (= *P. ludlowii*) 1, 8, 17, 47, 61
 var. *superba* (Lemoine) Hort ex Gard. Chron. (1908) (= *P. delavayi*) 66
macrophylla Lomakin (1897) (= *P. daurica* subsp. *macrophylla*) 13, 15, 16, 21, 25, 57, 174
mairei H. Lév. (1915) 9, 15, 27, 31, 32, 37, 38, 55, 58, 59, 190, **191**, 192
 f. *oxypetala* (Hand.-Mazz.) W. P. Fang (1958) (= *P. mairei*) 191
majko Ketsk. (1959) (= *P. ×saundersii* Stebbins (*P. tenuifolia* × *P. daurica*)) 18, 211, 243
makoya W. H. Baxter & Wooster (1850), pro syn. sub *P. albiflora* (= *P. lactiflora*)
mas Garsault (1764), nom. illeg. 180, 181
mascula (L.) Mill. (1768) 3, 5, 9, 11, 14, 15, 16, 18, 19, 24, 25, 26, 27, 29, 33, 34, 35, 36, 37, 45, 46, 47, 53, 55, 57, 58, 60, 154, 170, 179, **180**, 181, 182, 183, 195, 198, 202, 224, 230
 subsp. *bodurii* N. Özhatay (1995) 4, 43, 182, **187**
 subsp. *arietina* (G. Anderson) Cullen & Heywood (1964) (= *P. arietina*) 4, 5, 18, 181, 182, 221, 223
 subsp. *atlantica* (Coss.) Greuter & Burdet (1982) (= *P. algeriensis*) 182, 202
 subsp. *cambessedesii* (Willk.) O. Bolòs & Vigo (1974) (= *P. cambessedesii*) 149
 subsp. *coriacea* (Boiss.) Malag. (1975), pro parte, excl. pl. Cors & Sardin. (= *P. coriacea*) 13, 153, 182, 189
 subsp. *hellenica* Tzanoud. (1977) 19, 43, 182, **187**, 224
 var. *icarica* (Tzanoud.) Stearn & P. H. Davis (1984) (= *mascula* subsp. *hellenica*) 187
 subsp. *hellenica* auct. non Tzanoud.: Stearn & P. H. Davis (1984), pro parte quoad pl. Sicil. (= *P. mascula* subsp. *russoi*) 182, 189
 subsp. *icarica* Tzanoud. (1977) (= *mascula* subsp. *hellenica*) 19, 182, 187
 subsp. *kesrouanensis* (Thiébaud) Halda (1997) (= *P. kesrouanensis*) 182, 189
 subsp. *mascula* 4, 13, 18, 19, 36, 38, 43, 171, 182, **183**, 187, 224
 var. *russoi* (Biv.) Passalacqua & Bernardo (2004) (= *P. mascula* subsp. *russoi*) 188
 subsp. *orientalis* (Thiébaud) D. Y. Hong (2000) (= *P. mascula* subsp. *mascula*) 182, 183
 subsp. *russoi* (Biv.) Cullen & Heywood (1964) 5, 18, 19, 24, 38, 43, 152, 156, 157, 182, **188**, 189

- subsp. *triternata* (Pall. ex DC.) Stearn & P. H. Davis (1984) (= *P. daurica*) 19, 168, 170, 171, 182
 var. *broteri* (Boiss. & Reut.) Gürke (1903) (= *P. broteri*) 159
 f. *ovatifolia* (Boiss. & Reut.) Cout. (1913) (= *P. broteri*) 160
 var. *corsica* (Sieber ex Tausch) Gürke (1903), pro parte, quoad pl. Cors. (= *P. corsica*) 152, 154
 var. *flavescens* (C. Presl) Gürke (1903) (= *P. mascula* subsp. *russoi*) 188
 var. *lusitanica* (Mill.) Samp. (1911) (= *P. broteri*) 159
 var. *ovatifolia* (Boiss. & Reut.) Gürke (1903), pro parte, quoad pl. Cors. (= *P. corsica*) 153, 160
 var. *russoi* (Biv.) Gürke (1903), pro parte, quoad pl. Sicil. (= *P. mascula* subsp. *russoi*) 152
 var. *triternata* (Pall. ex DC.) Gürke (1903) (= *P. daurica*) 168
mascula L. ex Desf. (1804), nom. illeg. (= *P. mascula*) 181
mascula L. ex Beck (1890), nom. illeg. (= *P. mascula*) 181
microcarpa Salm-Dyck (1834) (= *P. officinalis* subsp. *huthii*) 13, 235
microcarpa Boiss. & Reut. (1852) (= *P. officinalis* subsp. *microcarpa*) 13, 237
mlokosewitschii Lomakin (1897) (= *P. daurica* subsp. *mlokosewitschii*) 3, 15, 16, 25, 26, 43, 56, 176, 177
modesta Jord. (1903) (= *P. officinalis* subsp. *microcarpa*) 15, 238
mollis G. Anderson (1818) (= *P. officinalis*) 10, 12, 229
monticola Jord. (1903) (= *P. officinalis* subsp. *huthii*) 15, 235
morisii Cesca, Bernardo & Passalacqua (2001) (= *P. corsica*) 24, 152, 157
moutan Sims (1808) (= *P. suffruticosa*) 10, 12, 13, 14, 15, 16, 51, 53, 241
 subsp. *atava* Brühl (1896) (= *P. rockii* subsp. *atava*) 82
 var. *anneslei* Sabine (1826) (= *P. suffruticosa*) 242
 var. *papaveracea* (Andrews) DC. (1818) (= *P. suffruticosa*) 242
multifida Gueldenst. (1791) (= *P. tenuifolia*) 208
multifida Salm-Dyck (1834) (= *P. peregrina*) 13, 215
nemoralis Salisb. (1796), nom. illeg. (= *P. officinalis* subsp. *officinalis*) 229
obovata Maxim. (1859) 1, 9, 13, 14, 15, 16, 17, 25, 26, 27, 31, 33, 37, 41, 44, 55, 57, 58, 60, **137**, 138, 139, 140, 148
 subsp. *japonica* (Makino) Halda (1997) (= *P. obovata*) 137
 subsp. *obovata* **138**, 139, 140, 142
 subsp. *willmottiae* (Stapf) D. Y. Hong & K. Y. Pan (2001) 42, 139, 140, 142, **148**
 var. *alba* Saunders (1934) (= *P. obovata* subsp. *obovata*) 138
 var. *amurensis* Schipcz. (1921) (= *P. obovata* subsp. *obovata*) 138
 var. *australis* Schipcz. (1921) (= *P. obovata* subsp. *obovata*) 138
 var. *glabra* Makino (1928) (= *P. obovata* subsp. *obovata*) 138
 var. *japonica* Makino (1898) (= *P. obovata*) 16, 137
 var. *typica* Makino (1898) (= *P. obovata* subsp. *obovata*) 138
 var. *willmottiae* (Stapf) Stern (1943) (= *P. obovata* subsp. *willmottiae*) 148
 f. *oreogeton* (S. Moore) Kitag. (1939) (= *P. obovata*) 137
officinalis L. (1753) 3, 10, 11, 12, 13, 15, 18, 21, 23, 25, 26, 27, 29, 35, 53, 54, 55, 56, 58, 59, 215, 224, **228**
 subsp. *officinalis* 18, 19, 21, 35, 229, 230, 231, **232**, 233, 240
 subsp. *banatica* (Rochel) Soó (1945) 5, 18, 31, 37, 220, 229, 230, 234, **233**
 subsp. *huthii* Soldano (1993) 21, 26, 35, 215, 229, 230, **235**, 240
 subsp. *italica* Passalacqua & Bernardo (2004) 229, 230, **237**
 subsp. *microcarpa* (Boiss. & Reut.) Nym. (1878) 7, 9, 13, 19, 21, 22, 23, 35, 37, 224, 229, 230, **237**, 238, 239, 240
officinalis (auct. non L.) sensu Retz. (1816) (= *P. peregrina*) 215
officinalis (auct. non L.) sensu Thunb. (1784) (= *P. lactiflora*) 111

- officinalis* (auct. non L.) sensu Hook. f. & Thomson (1855) (= *P. emodii*) 118
 subsp. *corallina* (Retz.) Fiori (1898) (= *P. mascula*) 181
 var. *corsica* (Sieber ex Tausch) Fiori (1898) (= *P. corsica*) 152, 154
 var. *mascula* (L.) Fiori (1898) (= *P. mascula*) 11, 153, 180, 181
 var. *triternata* (Pall. ex DC.) Fiori (1898) (= *P. daurica*) 153, 168
 subsp. *euofficinalis* var. *feminea* (L.) Fiori (1898) (= *P. officinalis* subsp. *officinalis*) 229
 subsp. *euofficinalis* var. *paradoxa* (G. Anderson) Fiori (1898) (= *P. officinalis*) 229
 subsp. *humilis* (Retz.) Cullen & Heywood (1964) (= *P. officinalis* subsp. *microcarpa*) 18, 21, 237
 subsp. *villosa* (Huth) Cullen & Heywood (1964) (= *P. officinalis* subsp. *huthii*) 18, 21, 235
 var. *albicans* Sabine (1817) (= *P. officinalis* subsp. *officinalis*) 232
 var. *anemoniflora* Hook. (1832) (= *P. officinalis* subsp. *officinalis*) 232
 var. *carnescens* Sabine (1817) (= *P. officinalis* subsp. *officinalis*) 232
 var. *cretica* (Tausch) Asch. & Graebn. (1923) (= *P. clusii*) 164
 var. *feminea* L. (1753) (= *P. officinalis*) 11, 229
 var. *glabra* (Boiss.) Hayek (1927), pro parte, excl. syn. *P. cretica* Sabine (= *P. clusii*) 164
 var. *hirsuta* (Mill.) Martyn (1807) (= *P. officinalis*) 229
 var. *humilis* (Retz.) Asch. & Graebn. (1923) (= *P. officinalis* subsp. *microcarpa*) 237
 f. *leiocarpa* (DC.) Asch. & Graebn. (1923) (= *P. officinalis* subsp. *microcarpa*) 238
 var. *lobata* (Desf.) Webb (1838), nom. nud. (= *P. broteri*) 160
 var. *lusitanica* (Mill.) Martyn (1807) (= *P. broteri*) 159
 var. *microcarpa* (Boiss. & Reut.) Samp. (1946) (= *P. officinalis* subsp. *microcarpa*) 237
 var. *officinalis* subvar. *banatica* (Rochel) Hayek (1927) (= *P. officinalis* subsp. *banatica*) 233
 var. *peregrina* (Mill.) Martyn (1807) (= *P. peregrina*) 213
 var. *rubra* Sabine (1817) (= *P. officinalis* subsp. *officinalis*) 232
 var. *russoi* (Biv.) Fiori (1898) (= *P. mascula* subsp. *russoi*) 188
 var. *tartarica* (Mill.) Martyn (1807) (= *P. peregrina*) 215
 var. *villosa* Asch. & Graebn. (1923) (= *P. officinalis* subsp. *huthii*) 235
officinalis β*mascula* L. (1753) (= *P. mascula*) 180
oreogeton S. Moore (1879) (= *P. obovata*) 13, 14, 16, 25, 137
ostii T. Hong & J. X. Zhang (1992) 9, 10, 19, 26, 33, 34, 36, 37, 43, 44, 51, 52, 53, 79, **84**, 85, 86, 97, 242
 subsp. *lishizhenii* (B. A. Shen) B. A. Shen (2001) (= *P. ostii*) 84
 var. *lishizhenii* B. A. Shen (1997) (= *P. ostii*) 84
oxypetala Hand.-Mazz. (1920) (= *P. mairei*) 15, 26, 191
pallens Sims ex Boiss. (1867) (pro *P. pullens*; pro syn. sub *P. peregrina* Mill.) (= *P. arietina*) 221
papaveracea Andrews (1807b) pro sp. (= *P. suffruticosa*) 10, 11, 242
papaveracea auct. non Andrews: Anonymous (1972) (= *P. rockii*) 78
parnassica Tzanoud. (1977) 19, 35, 37, 44, 55, 56, 58, 59, 220, 224, 225, 226, **227**, 228
paradoxa G. Anderson (1818) (= *P. officinalis*) 12, 13, 229, 237
 var. *fimbriata* Sabine (1817) (= *P. officinalis*) 229
 var. *leiocarpa* DC. (1824) (= *P. officinalis* subsp. *microcarpa*) 238
peregrina Mill. (1768) 4, 10, 11, 12, 14, 15, 17, 18, 19, 21, 24, 25, 26, 27, 35, 37, 55, 56, 58, 59, 164, **213**, 214, 215, 216, 217, 220, 221, 230
 var. *banatica* (Rochel) Huth (1891) (= *P. officinalis* subsp. *banatica*) 233
 var. *compacta* G. Anderson (1818) (= *P. officinalis* subsp. *huthii*) 235
 var. *cretica* (Tausch) Huth (1891) (= *P. clusii*) 164
 var. *genuina* Lazaro (1907) (= *P. officinalis* subsp. *microcarpa*) 238
 var. *glabra* Boiss. (1867) (= *P. clusii*) 164
 var. *humilis* (Retz.) Huth (1891) (= *P. officinalis* subsp. *microcarpa*) 237

- var. *latifolia* Boiss. (1867) (= *P. parnassica*) 227
- var. *leiocarpa* (DC.) Coss. (1851) (= *P. officinalis* subsp. *microcarpa*) 238
- var. *officinalis* (Retz.) Huth (1891) (= *P. officinalis* subsp. *officinalis*) 232
- var. *paradoxa* sensu Gautier (1898), non G. Anderson (= *P. officinalis* subsp. *microcarpa*) 238
- var. *villosa* Huth (1891) (= *P. officinalis* subsp. *huthii* and subsp. *italica*) 235, 237
- f. *angustata* Rouy & Foucaud (1893) (= *P. officinalis* subsp. *huthii*) 15, 234
- f. *leiocarpa* (DC.) Rouy & Foucaud (1893) (= *P. officinalis* subsp. *microcarpa*) 238
- f. *microcarpa* (Boiss. & Reut.) Rouy & Foucaud (1893) (= *P. officinalis* subsp. *microcarpa*) 237
- f. *officinalis* (L.) Rouy & Foucaud (1893) (= *P. officinalis* subsp. *officinalis*) 232
- f. *paradoxa* (G. Anderson) Rouy & Foucaud (1893) (= *P. officinalis*) 229
- peregrina* (auct. non Mill.) sensu Boiss. (1867) (= *P. arietina*) 221
- peregrina* (auct. non Mill.) sensu Sims (1807) (= *P. arietina*) 221, 229, 236
- porrigens* Rchb. (1832) (= *P. officinalis*) 13, 228
- potaninii* Kom. (1921) (= *P. delavayi*) 1, 8, 9, 15, 16, 23, 26, 66, 69, 70
- var. *trollioides* (Stapf ex Stern) Stern (1943) (= *P. delavayi*) 9, 17, 66
- f. *alba* (Bean) Stern (1946) (= *P. delavayi*) 66
- promiscua* Tausch (1828) (= *P. officinalis*) 12, 13, 228
- pubens* Sims (1821) (= *P. officinalis*) 13, 228
- pullens* Sims ex Boiss. (1867) (err. *P. pallens*; pro syn. sub *P. peregrina* Mill.) (= *P. arietina*) 221
- qini** Y. L. Pei & D. Y. Hong (1995) 1, 9, 20, 26, 34, 36, 37, 44, 51, 52, 53, 79, **91**, 92, 93, 94, 96, 242
- reevesiana* (Paxton) Baxter & Wooster (1850), pro syn. sub *P. albiflora* (= *P. lactiflora*) 111
- revelieri* Jord. (1903) (= *P. corsica*) 15, 152, 157
- rhodia* Stearn (1941) (= *P. clusii* subsp. *rhodia*) 17, 18, 19, 26, 56, 167
- ridleyi* Z. L. Dai & T. Hong (1997) (= *P. qini*) 1, 20, 91
- rockii** (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong (1998) 7, 9, 10, 20, 23, 26, 33, 34, 37, 42, 44, 51, 52, 53, **78**, 80, 82, 242
- subsp. **atava** (Brühl) D. Y. Hong & K. Y. Pan (2005) 34, **82**, 83, 242, 243
- subsp. *lanceolata* Y. L. Pei & D. Y. Hong (1993), nom. inval. (= *rockii* subsp. *rockii*) 79
- subsp. *linyanshanii* T. Hong & G. L. Osti (1994), nom. inval. (= *P. rockii* subsp. *rockii*) 79
- subsp. *linyanshanii* (Halda) T. Hong & G. L. Osti ex X. Y. Zhu & T. Hong (2005) (= *P. rockii* subsp. *rockii*) 79
- subsp. **rockii** 1, 34, **79**, 242
- subsp. *taibaishanica* D. Y. Hong (1998) (= *P. rockii* subsp. *atava*) 82
- romanica* D. Brândză (1881) (= *P. peregrina*) 14, 215
- rosea* J. St.-Hil. (1809) (= *P. officinalis* subsp. *microcarpa*) 12, 237
- rosea* (auct. non J. St.-Hil.) sensu Host (1831) (= *P. officinalis*) 13, 229, 233
- ruprechtiana* Kem.-Nath. (1961) (= *P. daurica* subsp. *coriifolia*) 18, 173
- russoi* Biv. (1816) (= *P. mascula* subsp. *russoi*) 15, 17, 25, 157, 181, 188
- var. *coriacea* (Boiss.) Coss. ex Batt. (1888) (= *P. coriacea* and *P. algeriensis*) 197, 202
- var. *leiocarpa* (Coss.) Stern (1943) (= *P. corsica*) 153, 154
- var. *reverchonii* Legrand (1899) (= *P. corsica*) 152, 157
- russoi* (auct. non Biv.) sensu Amo y Mora (1873) (= *P. coriacea*) 197
- russoi* auct. non Biv.: Stern (1946), pro parte, quoad pl. Cors. & Sardin. (= *P. corsica*) 152
- saueri** D. Y. Hong, X. Q. Wang & D. M. Zhang (2004) 30, 33, 35, 36, 37, 55, 58, 59, **218**, 219
- sessiliflora* Sims (1826) (= *P. officinalis*) 228
- sibirica* Pall. (1788), nom. nud. (= *P. anomala*) 11, 125, 126, 130
- sinensis* Hort. ex Steud. (1841), pro syn. sub *P. albiflora* (= *P. lactiflora*) 111
- sinjiangensis* K. Y. Pan (1979) (= *P. anomala* subsp. *anomala*) 19, 24, 127

- spontanea* (Rehder) T. Hong & W. Z. Zhao (1994) (= *P. jishanensis*) 20, 87, 88
- sterniana*** H. R. Fletcher (1959) 18, 26, 31, 32, 35, 39, 42, 55, 56, 59, 119, 121, **122**, 123, 124
- steveniana* Kem.-Nath. (1961) (= *P. daurica* subsp. *macrophylla*) 13, 175
- subternata* Salm-Dyck (1834) (= *P. officinalis*) 13, 229
- suffruticosa* Andrews (1804) (pro sp.) (= *P. suffruticosa*) 7, 9, 10, 11, 13, 16, 18, 19, 23, 33, 51, 52, 53, 75, 241
- subsp. *atava* (Brühl) S. G. Haw & Lauener (1990) (= *P. rockii* subsp. *atava*) 82
- subsp. *ostii* (T. Hong & J. X. Zhang) Halda (1997) (= *P. ostii*) 84
- subsp. *rockii* S. G. Haw & Lauener (1990) (= *P. rockii*) 19, 78, 242
- var. *linyanshanii* Halda (1997) (= *P. rockii* subsp. *rockii*) 79
- subsp. *spontanea* (Rehder) S. G. Haw & Lauener (1990) (= *P. jishanensis*) 19, 87, 88, 90
- var. *jishanensis* (T. Hong & W. Z. Zhao) Halda (1997) (= *P. jishanensis*) 87
- subsp. *suffruticosa* (= *P. suffruticosa*) 84
- subsp. *yinpingmudan* D. Y. Hong, K. Y. Pan & Z. W. Xie (1998b), pro parte, quoad pl. Anhui (= *P. ostii*) 9, 84, 94, 96, 97
- var. *papaveracea* (Andrews) Kerner (1816) (= *P. suffruticosa*) 242
- var. *papaveracea* auct. non Andrews: K. Y. Pan (1979) (= *P. rockii*) 78
- var. *purpurea* Andrews (1807a) (= *P. suffruticosa*) 11, 241
- var. *qiui* (Y. L. Pei & D. Y. Hong) Halda (1997) (= *P. qiui*) 91
- var. *spontanea* Rehder (1920), pro parte, excl. specim. Tai-Pei-Shan (= *P. jishanensis*) 19, 20, 87, 91
- f. *anneslei* (Sabine) Rehder (1920) (= *P. suffruticosa*) 242
- suffruticosa* auct. non Andrews: Stern (1946) (= *P. rockii*) 78
- suffruticosa* auct. non Andrews: Grierson (1984) (= *P. rockii* subsp. *atava*) 82
- szechuanica* W. P. Fang (1958) (= *P. decomposita*) 18, 23, 74
- tartarica* Mill. (1768) (= *P. peregrina*) 11, 12, 14, 215, 216
- tenuifolia*** L. (1759) 3, 9, 11, 12, 14, 15, 16, 18, 25, 26, 31, 33, 35, 37, 39, 40, 44, 49, 55, 58, 59, 205, **208**, 209, 210, 211, 212, 243
- subsp. *biebersteiniana* (Rupr.) Halda (1997) (= *P. tenuifolia*) 208
- var. *biebersteiniana* (Rupr.) N. Busch (1901) (= *P. tenuifolia*) 208
- var. *hybrida* (Pall.) Lipsky (1889) (= *P. tenuifolia*) 208
- var. *laciniata* Salm-Dyck (1834) (= *P. tenuifolia*) 13, 208
- var. *latisecta* Neilr. (1870) (= *P. tenuifolia*) 208
- var. *parviflora* Huth (1891) (= *P. tenuifolia*) 208
- f. *brevifolia* (Prodan) Borza (1947) (= *P. tenuifolia*) 210
- f. *latifolia* (Prodan) Borza (1947) (= *P. tenuifolia*) 210
- f. *latisecta* (Neilr.) Borza (1947) (= *P. tenuifolia*) 208
- f. *normalis* A. Nyár. (1953) (= *P. tenuifolia*) 210
- f. *parviflora* (Huth) Borza (1947) (= *P. tenuifolia*) 208
- tomentosa* (Lomakin) N. Busch (1919) (= *P. daurica* subsp. *tomentosa*) 16, 25, 35, 177
- trternata* Pall. ex DC. (1824) (= *P. daurica*) 9, 16, 25, 26, 57, 157, 168, 173, 176, 181
- var. *mlokosewitschii* (Lomakin) Stebbins (1938) (= *P. daurica* subsp. *mlokosewitschii*) 176
- f. *coriifolia* Rupr. (1869) (= *P. daurica* subsp. *coriifolia*) 173
- trollioides* Stapf ex Stern (1931) (= *P. delavayi*) 16, 26, 43, 66, 70, 73
- turcica* P. H. Davis & Cullen (1965) (= *P. kesrouanensis*) 4, 5, 18, 46, 195, 196
- veitchii* Lynch (1909) (= *P. anomala* subsp. *veitchii*) 10, 15, 16, 17, 19, 21, 23, 26, 39, 41, 111, 127, 132
- subsp. *altaica* (K. M. Dai & T. H. Ying) Halda (1997) (= *P. anomala* subsp. *anomala*) 127
- subsp. *veitchii* var. *woodwardii* (Stapf ex Cox) Halda (2004) (= *P. anomala* subsp. *veitchii*) 133

- var. *beresowskii* (Kom.) Schipcz. (1921) (= *P. anomala* subsp. *veitchii*) 15, 132
 var. *leiocarpa* W.T. Wang & S. H. Wang ex K. Y. Pan (1979) (= *P. anomala* subsp. *veitchii*) 133
 var. *purpurea* Schipcz. (1921) (= *P. anomala* subsp. *veitchii*) 133
 var. *uniflora* K. Y. Pan (1979) (= *P. anomala* subsp. *veitchii*) 10, 26, 41, 133
 var. *woodwardii* (Stapf ex Cox) Stern (1943) (= *P. anomala* subsp. *veitchii*) 39, 133
vernalis Mandl (1921) (= *P. obovata*) 16, 25, 137
villarsii Jord. (1903) (= *P. officinalis* subsp. *microcarpa*) 15, 237
villosa Desf. (1804), nom. nud. (= *P. officinalis* subsp. *microcarpa*) 11, 13, 15, 35, 235, 238
villosa sensu Sweet (1827), non Desf. (1804) (= *P. officinalis*) 229
whitleyi (Sabine) Hort ex Garden (1889) (= *P. lactiflora*) 110
willmottiae Stapf (1916) (= *P. obovata* subsp. *willmottiae*) 15, 148
wittmanniana auct. non Hartwiss ex Lindl.: Davis, Mill & Kit Tan (1988) (= *P. daurica* subsp. *macrophylla*)
wittmanniana auct. non Hartwiss ex Lindl.: Reidl (1969) (= *P. daurica* subsp. *tomentosa*)
wittmanniana Hartwiss ex Lindl. (1846) (= *P. daurica* subsp. *wittmanniana*) 3, 13, 14, 15, 16, 25, 26, 54, 58, 179
wittmanniana Hartwiss ex Lindl. var. *nudicarpa* Schipcz. (1921) (= *P. daurica* subsp. *macrophylla*) 175
wittmanniana Steven (1848) (= *P. daurica* subsp. *macrophylla*) 174
 subsp. *tomentosa* (Lomakin) N. Busch (1901) (= *P. daurica* subsp. *tomentosa*) 176
 var. *macrophylla* (Albov) N. Busch ex Grossh. (1930) (= *P. daurica* subsp. *macrophylla*) 174
 var. *tomentosa* Lomakin (1897) (= *P. daurica* subsp. *tomentosa*) 15, 176
 f. *macrophylla* (Albov) N. Busch (1901) (= *P. daurica* subsp. *macrophylla*) 174
woodwardii Stapf ex Cox (1930) (= *P. anomala* subsp. *veitchii*) 16, 133
yinpingmudan (D. Y. Hong, K. Y. Pan & Z. W. Xie) B. A. Shen (2001) (= *P. ostii*) 84
 subsp. *henanensis* B. A. Shen (2001) nom. illeg. (= *P. cathayana*) 94, 97
yui W. P. Fang (1958) (= *P. lactiflora*) 18, 111
yunnanensis W. P. Fang (1958) (= *P. suffruticosa*) 18, 242

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(Abbreviations follow Brummitt & Powell, 1992.)

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- Amo** — Amo y Mora, Mariano del (1809–1896), Spanish botanist.
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- Delavay** — Delavay, Pierre Jean Marie (1834–1895), French missionary and plant collector in China.
- Donn** — Donn, James (1758–1813), British gardener.
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- Gaut.** — Gautier, Marie Clément Gaston (1841–1911), French botanist.
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- Halda** — Halda, Josef. J. (fl. 1997), Czech gardener.
- Hand.-Mazz.** — Handel-Mazzetti, Heinrich Freiherr von (1882–1942), Austrian botanist and explorer.
- H. Hara** — Hara, Hiroshi (1911–1986), Japanese botanist at the University of Tokyo.
- Hartwiss** — Hartwiss, Nicolai Anders von (1791–1860).
- S. G. Haw** — Haw, Stephen G. (fl. 1980s), British horticulturist and botanist.
- Hayek** — Hayek, August (Edler) von (1871–1928), Austrian botanist and physician.
- Heywood** — Heywood, Vernon Hilton (1927–), British botanist.
- D. Y. Hong** — Hong, De-Yuan (1937–), Chinese botanist at the Chinese Academy of Sciences, Beijing.
- T. Hong** — Hong, Tao, Chinese botanist at Chinese Academy of Forestry.
- Hook.** — Hooker, William Jackson (1785–1865), British botanist, director of the Royal Botanic Gardens, Kew.
- Hook. f.** — Hooker, Joseph Dalton (1817–1911), British botanist and pioneering plant geographer.
- Host** — Host, Nicolaus Thomas (1761–1834), Austrian imperial physician to Franz I and botanist at Vienna.
- Huth** — Huth, Ernst (1845–1897), German botanist.
- Jahand.** — Jahandiez, Émile (1876–1938), French botanist and horticulturist.
- Janka** — Janka, Victor von (1837–1900), Austrian soldier and botanist.
- Jord.** — Jordan, (Claude Thomas) Alexis (1814–1897), French botanist whose extremely narrow species concept led to “jordanism” and Jordan-species (jordanons).
- Kem.-Nath.** — Kemularia-Nathadze, Liubov Manucharovna (1891–1985), Georgian botanist.
- Ketsk.** — Ketskoveli (Ketzchoveli), Nikolay (Nikolai) Nikolaevich (1897–1982), Georgian botanist.
- Kitag.** — Kitagawa, Masao (1909–?), Japanese botanist at Yokohama National University.
- W. D. J. Koch** — Koch, Wilhelm Daniel Joseph (1771–1849), German physician and botanist.
- Kom.** — Komarov, Vladimir Leontjevic (1969–1945), Russian botanist.
- Korsh.** — Korshinsky, Sergei Iwanowitsch (Ívanovitsch) (1861–1900), Russian botanist.
- Kotov** — Kotov, Mikhail Ivanovich (1896–1978), Ukrainian botanist.
- Krasnob.** — Krasnoborov, Ivan M. (1931–), Russian botanist.
- Krylov** — Krylov (Krylow), Porphyry Nikitic (1850–1931), Russian botanist.
- Lauener** — Lauener, Lucien André (Andrew) (1918–1991), British botanist.
- Lazaro** — Lazaro é Ibiza, Blas (1858–1921), Spanish botanist.
- Ledeb.** — Ledebour, Carl (Karl) Friedrich von (1785–1851), German botanist.
- Legrand** — Legrand (Le Grand), Antoine (1839–1905), French botanist.
- Lemoine** — Lemoine, (Pierre Louis) Victor (1823–1911), French horticulturist.
- H. Lév.** — Lévillé, Augustin Abel Hector (1863–1918), French botanist and clergyman.
- J. J. Li** — Li, Jia-Jue (c. 1939–), Chinese horticulturist.
- Link** — Link, Johann Heinrich Friedrich (1767–1851), German nature philosopher and botanist.
- Lindl.** — Lindley, John (1799–1865), British botanist.

- L.** — Linnaeus, Carl (Linné, Carl von from 1761) (1707–1778), Swedish botanist, physician and zoologist.
- Lipsky** — Lipsky, Vladimir Ippolitovitch (1863–1937), Russian botanist and explorer of Central Asia.
- Lomakin** — Lomakin, Aleksandr Aleksandrovich (1863–1930), Russian botanist.
- Loudon** — Loudon, John Claudius (1783–1843), British gardener, horticultural writer and botanist.
- Lour.** — Loureiro, João de (1717–1791), Portuguese missionary and naturalist in Moçambique, Goa, and Cochinchina.
- Lynch** — Lynch, Richard Irwin (1850–1924), British botanist and horticulturist.
- Maire** — Maire, René Charles Joseph Ernest (1878–1949), French botanist.
- Makino** — Makino, Tomitaro (1862–1957), Japanese botanist and botanical artist.
- Malag.** — Malagarriga, Teodoro Luis Ramón Peñafier (1904–1990).
- Mandl** — Mandl, K. S.
- Martyn** — Martyn, Thomas (1735–1825), British botanist.
- Maxim.** — Maximowicz, Carl Johann (1827–1891), Russian botanist and explorer.
- Meikle** — Meikle, Robert Desmond (1923–), British botanist.
- C.A. Mey.** — Meyer, Carl Anton (Andreeviā) von (1795–1855), Russian botanist and explorer.
- Mill.** — Miller, Philip (1691–1771), British gardener, superintendent of the Society of Apothecaries at Chelsea.
- Miscz.** — Misczenko, Pavel Ivanovich (1869–1938).
- Miyabe** — Miyabe, Kingo (1861–1951), Japanese botanist.
- S. Moore** — Moore, Spencer Le Marchant (1850–1931), British botanist and explorer.
- Moris** — Moris, Giuseppe Giacinto (Joseph Hyacinthe) (1796–1869), Italian botanist.
- Moss** — Moss, Charles Edward (1870–1930), British botanist.
- Mouterde** — Mouterde, Paul (1892–1972), French Jesuit and botanist, botanical explorer of Syria and Lebanon.
- J. A. Murray** — Murray, Johan Andreas (Anders) (1740–1791), Swedish botanist.
- Nakai** — Nakai, Takenoshin (1882–1952), Japanese botanist.
- Neilr.** — Neilreich August (1803–1871), Austrian botanist.
- Nutt.** — Nuttall, Thomas (1786–1859), British naturalist, pioneering scientific explorer of the United States.
- Nyár.** — Nyárády, Erasmus Julius (1881–1966), Romanian botanist.
- A. Nyár.** — Nyárády, Anton (1920–), Romanian botanist.
- Nym.** — Nyman, Carl Fredrik (1820–1893), Swedish botanist.
- Oken** — Oken, Lorenz (1779–1851), German naturalist, physician, philosopher and philologist.
- Ovcz.** — Ovczinnikov, Pavel Nikolaevich (1903–1979), Tajikistani botanist.
- N. Özhatay** — Özhatay, Neriman (1947–), Turkish botanist at Istanbul.
- Pall.** — Pallas, Peter Simon (1741–1811), German (Berlin) botanist and geographer; explorer of Russia, especially Siberia, pioneer naturalist of northern Asia.
- K. Y. Pan** — Pan, Kai-Yu (1937–), Chinese botanist.
- Paol.** — Paoletti, Giulia (1865–1941), Italian botanist.
- Pau** — Pau (y Español), Carlos (1857–1937), Spanish botanist and pharmacist.
- Paxton** — Paxton, Joseph (1803–1865), British horticulturist and landscape gardener.
- Pignatti** — Pignatti, Sandro (Alessandro) (1930–), Italian botanist.
- C. Presl** — Presl, Carl (Karl, Carel, Carolus) Bofivoj (Boriwog, Boriwag) (1794–1852), Czech botanist.
- Pursh** — Pursh, Frederick Traugott (1774–1820), German botanist.
- Raulin** — Raulin, Victor Félix (1815–1905), French botanist.
- Redouté** — Redouté, Pierre Joseph (1759–1840), Luxemburg-born botanic artist working in Paris.
- Regel** — Regel, Eduard (August) von (1815–1892), German (Thuringian) botanist working at the Imperial Botanical Garden, St. Petersburg (1855–1892).
- Rehder** — Rehder, Alfred (1863–1949), German (Saxonian) botanist, working in the United States (Harvard University) from 1898.
- Rchb.** — Reichenbach, (Heinrich Gottlieb) Ludwig (1793–1879), German (Saxonian) botanist.
- Retz.** — Retzius, Anders Jahan (1742–1821), Swedish botanist at Lund.
- Reut.** — Reuter, George François (1805–1872), Swiss (French-born) botanist.
- Rochel** — Rochel, Anton (1770–1847), Austrian botanist and surgeon.
- Romo** — Romo, Angel María (1955–).
- Rouy** — Rouy, Georges (C. Ch.) (1851–1924), French floristic botanist in Paris.
- Royle** — Royle, John Forbes (1800–1858), British botanist and physician.
- Rupr.** — Ruprecht, Franz Josef (1770–1837), British barrister and horticulturist.

- J. St.-Hil.** — Saint-Hilaire, Jean Henri Jaume (1772–1845), French botanist.
- Salisb.** — Salisbury, Richard Antony (1761–1892), British botanist, gardener and botanical artist.
- Salm-Dyck** — Salm-Reifferscheid-Dyck, Joseph Maria Franz Anton Hubert Ignaz, Fürst und Altgraf zu (1773–1861), German (Prussian) botanist, botanical artist and horticulturist.
- Samp.** — Sampaio, Gonalo Ant3nio da Silva Ferreira (1865–1937), Portuguese botanist.
- Schipc.** — Schipczinsky (Schipczinski), Nikolaj Valerianovich (1886–1955), Russian botanist.
- Ser.** — Seringe, Nicolas Charles (1776–1858), French botanist.
- Sieber** — Sieber, Franz(e) Wilhelm (1789–1844), Bohemian botanist, traveller and plant collector.
- Sims** — Sims, John (1749–1831), British physician and botanist.
- Stapf** — Stapf, Otto (1857–1933), Austrian botanist, at Kew from 1890.
- Stearn** — Stearn, William Thomas (1911–2001), British botanist working at the Royal Horticultural Society and British Museum of Nature History.
- Stebbins** — Stebbins, G. Ledyard (1906–2000), American botanist and geneticist.
- Stern** — Stern, Frederick Claude (1884–1967), British banker, soldier, horticulturist and botanist.
- Steud.** — Steudel, Ernst Gottlieb von (1783–1856), German botanist and physician.
- Steven** — Steven, Christian von (1781–1863), Finnish botanist in Southern Russia, the Crimea and Ukraine from 1806.
- K. Sun** — Sun, Kun (fl. 1992), Chinese botanist.
- Sweet** — Sweet, Robert (1783–1835), British horticulturist, botanist and ornithologist.
- Takeda** — Takeda, Hisayoshi (1883–1972), Japanese botanist.
- Tausch** — Tausch, Ignaz Friedrich (1793–1848), Bohemian botanist at Prague.
- G. Taylor** — Taylor, George (1904–?), British botanist, collected in the Himalayas in 1934–1935.
- Thi3baut** — Thi3baut, Jean (?–1953), French botanist for the flora of Lebanon and Syria.
- Thomson** — Thomson, Thomas (1817–1878), British physician and botanist, student of W. J. Hooker.
- Thunb.** — Thunberg, Carl Peter (1743–1828), Swedish botanist.
- Torr.** — Torrey, John (1796–1873), American botanist and chemist.
- Trab.** — Trabut, Louis (Charles) (1853–1929), French botanist.
- Trautv.** — Trautvetter, Ernst Rudolf von (1809–1889), Courland-born Baltic-Russian botanist.
- Tzanoud.** — Tzanoudakis, Domitris (1950–), Greek botanist at University of Patras.
- M. S. Uspensk.** — Uspenskaya, M. S. (fl. 1987), Russian botanist.
- Vigo** — Vigo Bonada, Josep (Vigo I Bonada, Josep) (1937–).
- Vilm.** — Vilmorin, (Pierre) Louis (Franois L3v4que) de (1816–1860), French botanist and plant breeder.
- Wall.** — Wallich, Nathaniel (1786–1854), Danish physician and botanist at Calcutta (1814–1846).
- S. H. Wang** — Wang, Shu-Hsiou (1936–), Chinese botanist.
- W. T. Wang** — Wang, Wen-Tsai (1926–), Chinese botanist at Beijing.
- S. Watson** — Watson, Sereno (1826–1892), American botanist.
- Webb** — Webb, Philip Barker (1793–1854), British naturalist.
- Wender.** — Wenderoth, Georg Wilhelm Franz (1774–1861), German botanist.
- Willk.** — Willkomm, (Heinrich) Moriz (1821–1895), German (Saxonian) botanist and explorer.
- E. H. Wilson** — Wilson, Ernest Henry (1876–1930), British-born American botanist, plant collector and traveller.
- Wooster** — Wooster, David (ca. 1824–1888), British nurseryman.
- T. H. Ying** — Ying, Te-Hsiao (fl. 1990), Chinese plant collector.
- Zagheri** — Zagheri, P.
- J. X. Zhang** — Zhang, Jia-Xun (fl. 1992), Chinese gardener.
- Zohary** — Zohary, Michael (1898–1983).

HERBARIA VISITED OR WITH SPECIMENS ON LOAN

(We are greatly indebted to curators and staff members for their generosity and assistance. Asterisks indicate newly created abbreviations. Superscript¹ denotes herbaria that loaned specimens)

- A**, Herbarium, Arnold Arboretum, Harvard University, Cambridge, Massachusetts 02138, U.S.A.
- ANK**, Herbaryumu, Ankara Üniversitesi Fen Fakültesi, Biyoloji Bölümü, Tando an, Ankara, Turkey.
- ATH**, Herbarium, Goulandris Natural History Museum, 13 Levidou Street, GR-145 62 Kifissia, Greece.
- B**, Herbarium, Botanischer Garten und Botanisches Museum Berlin-Dahlem, Königin-Luise-Strasse 6-8, D-1000 Berlin 33, Federal Republic of Germany¹.
- BAK**, Herbarium, Botanical Institute of the Azerbaijan Academy of Sciences, Potamdarskoye Av. 40, 370073 Baku, Azerbaijan.
- BATU**, Herbarium, Botany Department, Batumi Botanical Garden, P/O Makhinjauri, 384533 Batumi, Georgia.
- BC**, Herbario, Institut Botànic de Barcelona, Avgda. Muntanyans s.n., Parc de Montjuïc, 08038 Barcelona, Spain¹.
- BEO**, Herbarium, Botany Department, Natural History Museum of Serbia, Njegševa 51, YU-11000 Beograd, Serbia.
- BGUB***, Herbarium, Botanic Garden, University of Belgrad, Belgrad, Serbia.
- BM**, Herbarium, Botany Department, The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.
- BP**, Herbarium, Botany Department, Hungarian Natural History Museum, Postafiók 222, Könyves Kálmán Körut 40, H-1476 Budapest VIII, Hungary.
- BUCA**, Herbarium, Taxonomie, Institutul de Științe Biologice, București 17, 77748 București VI, Romania¹.
- CAL**, Central National Herbarium, Botanical Survey of India, Botanical Garden, Howrah-711103, India.
- CAS**, Herbarium, Botany Department, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, U.S.A.
- CLF**, Herbar, Laboratoire de Botanique, Faculté des Sciences, Université Blaise Pascal, 4 rue Ledru, F-63038 Clermont-Ferrand Cedex, France.
- COI**, Herbarium, Botanical Institute, University of Coimbra, Apartado 3011, P-3049 Coimbra, Portugal¹.
- CPB**, Museum of Traditional Chinese Drugs, National Institute for the Control of Pharmaceutical and Biological Products, 2 Tiantanxili, Beijing 100050, China.
- E**, Herbarium, Royal Botanic Garden, Edinburgh EH3 5LR, U.K.
- G**, Herbarium, Conservatoire et Jardin botaniques de la Ville de Genève, Case postale 60, CH-1292 Chambésy-Genève, Switzerland.
- GZU**, Herbarium, Institut für Botanik, Karl-Franzens-Universität Graz, Holteigasse 6, A-8010 Graz, Austria¹.
- HGAS**, Herbarium, Institute of Biology, Guizhou Academy of Sciences, Guiyang, Guizhou 550009, China.
- HIMC**, Herbarium, Department of Biology, Inner Mongolia University, 1 Daxue Road, Hohhot, Inner Mongolia 010021, China.
- HNWP**, Herbarium, Northwest Plateau Institute of Biology, Chinese Academy of Sciences, 78 Xiguan Street, Xining, Qinghai 810001, China.
- IDS**, Herbarium, Idaho Museum of Natural History, Box 8096, Idaho State University, Pocatello, Idaho 83209, U.S.A.
- IFP**, Herbarium, Institute of Applied Ecology, Chinese Academy of Sciences, 72 Wenhua Road, Shenyang, Liaoning 110015, China.
- K**, Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, U.K.
- KATH**, National Herbarium and Plant Laboratories, Department of Forestry and Plant Research, P.O. Box 3708, Kathmandu, Nepal.

- KUN**, Herbarium, Kunming Institute of Botany, Chinese Academy of Sciences, Heilongtan, Kunming, Yunnan 650204, China.
- KYO**, Herbarium, Botany Department, Faculty of Science, Kyoto University, Kyoto-shi, Kyoto 606, Japan.
- LD**, Herbarium, Botanical Museum, Ö. Vallgatan 18, S-223 61 Lund, Sweden.
- LE**, Herbarium, V. L. Komarov Botanical Institute of the Russian Academy of Sciences, Prof. Popov Street, 197022 St. Petersburg, Russia.
- LINN**, Herbarium, Linnean Society of London, Burlington House, Piccadilly, London W1V 0LQ, U.K.
- M**, Herbarium, Botanische Staatssammlung, Menzinger Strasse 67, D-8000 München 19, Germany.
- MA**, Herbario, Real Jardín Botánico, Plaza de Murillo 2, 28014 Madrid, Spain.
- MO**, Herbarium, Missouri Botanical Garden, P.O. Box 299, St Louis, Missouri 63166-0299, U.S.A.
- MPU**, Herbier, Institut de Botanique, 163 rue Auguste Broussonnet, F-34000 Montpellier, France.
- NAS**, Herbarium, Jiangsu Institute of Botany, 1 Qianghuuocun, Nanjing, Jiangsu 210014, China¹.
- NSAD***, Herbarium, Institute for the Nature Protection, Novi Sad, Serbia¹.
- NWTC**, Herbarium, Northwest Normal University, Shilidian, Lanzhou, Gansu 730070, China.
- P**, Herbier, Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, 16 rue Buffon, F-75005 Paris, France.
- PE**, Herbarium, Institute of Botany, Chinese Academy of Sciences, Xiangshan, Beijing 100093, China.
- RO**, Erbario, Dipartimento di Biologia Vegetale, Università degli Studi di Roma "La Sapienza", Città Universitaria, I-00185 Roma, Italy¹.
- SA**, Dr W. Sauer's Herbarium, Im Buckenloh 9, D-72070 Tübingen, Germany.
- SAPS**, Herbarium, Botanical Institute, Faculty of Agriculture, Hokkaido University, Sapporo, Hokkaido 060, Japan.
- SHI**, Herbarium, Department of Biology, Shihezi University, Shihezi, Xinjiang 832003, China.
- SHMU**, Medical Herbarium, School of Pharmacy, Medical Science Division, Fudan University, 138 Yixueyuan Road, Shanghai 200032, China¹.
- SM**, Herbarium, Chongqing Institute of Chinese Materia Medica, Huangjueya, Nan'an, Chongqing 630065, China.
- SNU**, Herbarium, Botany Department, Seoul National University, Seoul 151, Korea.
- SOM**, Herbarium, Institute of Botany, Bulgarian Academy of Sciences, Str. "Akad. G. Bonăev", blok 23, Sofia 1113, Bulgaria¹.
- SZ**, Herbarium, Department of Biology, Sichuan University, Jiuyangqiao, Chengdu, Sichuan 610064, China.
- TBI**, Herbarium, Botanical Institute of the Georgian Academy of Sciences, Kodjorskoje Highway, 380007 Tbilisi, Georgia.
- TI**, Herbarium, Botanical Gardens, University of Tokyo, 3-7-I Hakusan, Bunkyo-ku, Tokyo-shi, Tokyo 112, Japan.
- TUB**, Herbarium, Institut für Biologie I, Lehrstuhl Spezielle Botanik, Eberhard-Karls-Universität Tübingen, Auf der Morgenstelle 1, D-7400 Tübingen I, Germany.
- UPA**, Herbarium, Botanical Museum, University of Patras, GR-260 10 Patras, Greece.
- UPS**, Botanical Museum (Fytoteket), Uppsala University, P.O. Box 541, S-751 21 Uppsala, Sweden¹.
- US**, United States National Herbarium, Botany Department, NHB-166, Smithsonian Institution, Washington, D.C. 20560-0001, U.S.A.
- W**, Herbarium, Department of Botany, Naturhistorisches Museum Wien, Burggring 7, A-1014 Wien, Austria.
- WU**, Herbarium, Institut für Botanik, Universität Wien, Rennweg 14, A-1030 Wien, Austria.
- WUK**, Herbarium, Northwestern Institute of Botany, 28 Xinong Road, Yangling, Shaanxi 712100, China.
- XE***, Herbarium, Xizang Plateau Institute of Ecology, Bayi, Nyingchi, Tibet, China.
- XJBI**, Herbarium, Xinjiang Institute of Geography and Ecology, Chinese Academy of Sciences, 40 Beijing South Road, Urumqi, Xinjiang 830011, China.
- XJNU**, Herbarium, Department of Biology, Xinjiang Normal University, 30 Kunlun Road, Xinjiang 830053, China.
- XJU**, Herbarium, Department of Biology, Xinjiang University, 14 Shengli Road, Urumqi, Xinjiang 830046, China.
- XZ**, Herbarium, Xizang Plateau Institute of Biology, 230 Beijing West Road, Lhasa, Tibet 850001, China.
- ZJFC**, Dendrological Herbarium, Department of Forestry, Zhejiang Forestry College, 62 Yijin Street, Lin'an, Zhejiang 311300, China.

HERBARIUM SPECIMENS EXAMINED AND THEIR SPECIES DESIGNATIONS

(The figures in square parentheses represent the species number given in this monograph, e.g. 1 = *P. ludlowii*, 20c = *Paeonia daurica* subsp. *macrophylla*.)

A. TYPE SPECIMENS

- Albov*, N. 156 and 160 (syntypes, G [20c]), 161 (syntype, K [20c]) and 157 (lectotype, G [20c]).
- Aznavaur*, G. V. s.n. 14 May 1905 (neotype of *Paeonia tartarica* Mill., G [28]).
- Bieberstein*, M. s.n. RUSSIA, near Stavropol (holotype of *Paeonia biebersteiniana* Rupr., LE [27]).
- Boissier* s.n. SPAIN, Sierra Nevada, Supra San Geronimo (lectotype of *Paeonia coriacea* Boiss., G [24]).
- Boissier*, E. s.n. June 1837 (lectotype of *Paeonia broteri* var. *ovatifolia* Boiss. & Reut., G; isoelectotype, G [18]).
- Briquet*, J. et al. s.n. 27 Apr. 1907 (lectotype of *Paeonia corallina* Retz. var. *pubescens* Moris f. *hypoleuca* Briq., G [17]).
- Buachidze*, I. s.n. 18 Apr. 1916 (holotype of *Paeonia ruprechtiana* Kem.-Nath., TBI [20b]).
- Cambessèdes* s.n. Feb. 1827 (lectotype of *Paeonia corallina* Retz. var. *cambessedesii* Willk., K [16]).
- Carrasco et al.* 17437SC (neotype of *Paeonia lusitanica* Mill., MA (No. 714084); isoneotypes, BM, G, K, PE [18]).
- Dai*, Z. L. 94053 (holotype of *Paeonia ridleyi* Z. L. Dai & T. Hong, China, Hubei Prov., Baokang Forestry Research Institute; photo, PE [7]).
- Dai*, Z. L., *Ran*, D. Y. & *Li*, Q. D. 96047 (holotype of *Paeonia baokangensis* Z. L. Dai & T. Hong, China, Hubei Prov., Baokang Forestry Research Institute; photo, PE [Hybrids-2]).
- Davis* 13327 (holotype of *Paeonia turcica* P. H. Davis & Cullen, K; isotype, E [23]).
- Delavay* 1142 (holotype of *Paeonia delavayi* Franch., P; isotypes, K, P [2]); s.n. 25 May 1883 (lectotype of *Paeonia lutea* Delavay ex Franch., P; isoelectotype, K [2]); s.n. 11 June 1883 and s.n. 9 May 1883 (syntypes of *Paeonia lutea* Delavay ex Franch., P [2]); *Paeonia* No.7 (syntype of *Paeonia lutea* Delavay ex Franch., P [2]).
- Douglas*, D. s.n. June–July 1826 (holotype of *Paeonia brownii* Douglas ex Hook., K [9]).
- El.* n. 6 ex herbier Boissier (syntype of *Paeonia coriacea* Boiss., G [24]).
- Engelhardt*, V. s.n. 19 Apr. 1938 (holotype of *Paeonia rhodia* Stearn, K [19b]).
- Farges*, R. P. 566 (holotype of *Paeonia bifurcata* Schipcz., LE; isotypes, K, P [22]).
- Farrer* no 8(?) (holotype of *Paeonia suffruticosa* Andrews subsp. *rockii* S. G. Haw & Lauener, E; photo, PE [4]).
- Feinbrun & Schwarz* s.n. 26 Sep. 1933 (holotype of *Paeonia kurdistanica* Zohary, photo, K; photo of isotype, K [21a]).
- Font Quer* 105 (lectotype of *Paeonia corallina* Retz. subsp. *coriacea* (Boiss.) Maire var. *maroccana* Pau & Font Quer ex Maire, BM; isoelectotypes, BC, G [24]).
- Forrest*, G. 13195 (lectotype of *Paeonia trollioides* Stapf ex Stern, E [2]); 12565 (syntype of *Paeonia trollioides* Stapf ex Stern, E [2]).
- Fridlender*, A. H01004 (neotype of *Paeonia corallina* Retz., PE; isoneotypes, A, CAS, BM, K, MO, P [21]).
- Fritz*, A. I. s.n. 10 Aug. 1913 (lectotype of *Paeonia vernalis* Mandl, LE [15]).
- Gombault* 3998 (lectotype of *Paeonia corallina* Retz. var. *orientalis* Thiébaud, P; isoelectotypes, BM, K, P [21a]).
- Handel-Mazzetti* 1735 (holotype of *Paeonia oxypetala* Hand.-Mazz., WU [22]).
- Heldreich* s.n. May 1846 (holotype of *Paeonia peregrina* Mill. var. *glabra* Boiss., BM; isotype, P [19]).
- Hong*, D. Y. & *Zhou*, S. L. H99028 (neotype of *Paeonia triternata* Pall. ex DC. f. *coriifolia* Rupr., K; isoneotypes, A, CAS, K, MO, PE, US [20b]).
- Hong*, D. Y. & *Zhu*, X. Y. PB85061 (holotype of *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li ex D. Y. Hong subsp. *taibaishanica* D. Y. Hong, PE [4b]).
- Hong*, D. Y., *Luo*, Y. B. & *He*, Y. H. H95033 (holotype of *Paeonia decomposita* Hand.-Mazz. subsp. *rotundiloba* D. Y. Hong, PE; isotypes, A, K, MO, US [3b]).
- Hong*, D. Y., *Pan*, K. Y. et al. H04040a (neotype of *Paeonia albiflora* Pall. var. *trichocarpa* Bunge, PE [11]).

- Hong, D. Y., Ye, Y. Z. & Feng, Y. X. H97010 (holotype of *Paeonia cathayana* D. Y. Hong & K. Y. Pan, PE; isotype, MO [8]).
- Hong, D. Y., Zhang, D. M. & Wang, X. Q. H02227 (holotype of *Paeonia saueri* D. Y. Hong, X. Q. Wang & D. M. Zhang, PE; isotypes, A, BM, CAS, K, MO, UPA [29]).
- Karo, F. 170 (neotype of *Paeonia lactiflora* Pall., WU; isoneotypes, E, K [11]).
- Kazarova & Dolukhanov s.n. 10 Apr. 1953 (holotype of *Paeonia lagodechiana* Kem.-Nath., TBI [20d]).
- Ketskovei, N. s.n. 4 May 1959 (holotype of *Paeonia majko* Ketsk., TBI [Hybrids-5]); s.n. 10 May 1958 (holotype of *Paeonia carthalinica* Ketsk., TBI [27]).
- King's Collector 549 (holotype of *Paeonia moutan* Sims subsp. *atava* Brühl, K [4b]).
- Kralik L. s.n. 18 July 1849 (holotype of *Paeonia corallina* Retz. var. *leiocarpa* Coss., P [17]); 99 (holotype of *Paeonia corallina* Retz. var. *atlantica* Coss., P; isotypes, BM, G, K, MPU [25]).
- Kümmerle, J. B. s.n. 12 June 1907 (holotype of *Paeonia daurica* Andrews subsp. *velebitensis* D. Y. Hong, BP [20f]).
- Ledebour s.n. the Altai Mountains (lectotype of *Paeonia intermedia* C. A. Mey., K; isoelectotype, LE [26]).
- Li, X. (H. Lee) 70316 (holotype of *Paeonia szechuanica* W. P. Fang, SZ; isotype, PE [3]); 70647, 70591, 70701, 71071 and 71387 (paratypes of *Paeonia szechuanica* W. P. Fang, PE, SZ [3]); 77248 (holotype of *Paeonia veitchii* Lynch var. *leiocarpa* W. T. Wang & S. H. Wang ex K. Y. Pan, PE [14b]).
- Ling, Y. R. 1141 (holotype of *Paeonia sinjiangensis* K. Y. Pan, PE [14]).
- Lomakin s.n. 17 June 1894 (lectotype of *Paeonia wittmanniana* Steven var. *tomentosa* Lomakin, TBI [20e]).
- Ludlow, F. & Sherriff, G. 1376 (paratype of *Paeonia lutea* Delavay ex Franch. var. *ludlowii* Stern & G. Taylor, BM [1]).
- Ludlow, F., Sherriff, G. & Elliot, H. H. 13543 (holotype of *Paeonia sterniana* H. R. Fletcher, BM [13]), 14231 (paratype of *Paeonia sterniana* H. R. Fletcher, BM [13]).
- Ludlow, F., Sherriff, G. & Taylor, G. 4540 (holotype of *Paeonia lutea* Delavay ex Franch. var. *ludlowii* Stern & G. Taylor, BM [1]), 6392 (paratype of *Paeonia lutea* Delavay ex Franch. var. *ludlowii* Stern & G. Taylor, BM [1]); 5350 and 5350a (paratypes of *Paeonia sterniana* H. R. Fletcher, BM [13]).
- Maak, R. K. s.n. 1859 (neotype of *Paeonia albiflora* var. *hirta* Regel, LE [11]).
- Maire, E. E. s.n. May 1911 (lectotype of *Paeonia mairei* H. Lév., E [22]).
- Massagetov, P. S. s.n. 12 June 1934 (neotype of *Paeonia wittmanniana* Hartwiss ex Lindl. var. *nudicarpa* Schipcz., LE [20c]).
- Maximowicz, C. J. s.n. 11 June 1856 (lectotype of *Paeonia obovata* Maxim., LE; isoelectotype, K [15]), s.n. 12 June 1855 and s.n. 16 Aug. 1856 (syntypes of *Paeonia obovata* Maxim., LE [15]).
- Miss Willmott 22 May 1915 (lectotype of *Paeonia willmottiae* Stapf, K [15b]).
- Mlokošewitsch 57 (neotype of *Paeonia mlokošewitschii* Lomakin, TBI; isoneotypes, E, LE [20d]).
- n° 211.1.C (lectotype of *Paeonia officinalis* var. *feminea* L., Clifford Herbarium, BM [32]).
- n° 692.1 (lectotype of *Paeonia officinalis* L., LINN [32]).
- n° 692.3 (lectotype of *Paeonia anomala* L., LINN [14]).
- n° 692.4 (lectotype of *Paeonia tenuifolia* L., LINN [27]; photo, F [27]).
- n° 211.1.A (lectotype of *Paeonia officinalis* var. *mascula* L., photo, BM [21]).
- Nakai, T. s.n. 9 June 1909 (holotype of *Paeonia albiflora* var. *trichocarpa* f. *nuda* Nakai, TI [11]).
- Nuttall s.n. the UNITED STATES of AMERICA, California, near St Barbara (lectotype of *Paeonia californica* Nutt. ex Torr. & A. Gray, K; isoelectotype, BM [10]).
- Orphanides, T. G. 445 (holotype of *Paeonia peregrina* var. *latifolia* Boiss., K; isotypes, G, WU [31]).
- Pallas, P. S. s.n. UKRAINE, Crimea (lectotype of *Paeonia triternata* Pall. ex DC., BM [20]).
- Pan, K. Y. & Xie, Z. W. 9701 (holotype of *Paeonia suffruticosa* Andrews subsp. *yinpingmudan* D. Y. Hong, K. Y. Pan & Z. W. Xie, PE [5]).
- Petrovic, S. s.n. Apr. 1884 (neotype of *Paeonia decora* G. Anderson, BM; isoneotype, G [28]).
- Prost s.n. FRANCE, Lozere, Mende (lectotype of *Paeonia peregrina* Mill. var. *villosa* Huth, G; isoelectotype, K [32c]).
- Purdom, W. 338 (lectotype of *Paeonia suffruticosa* Andrews var. *spontanea* Rehder, A; isoelectotypes, CAS, E, K, P, US [6]).
- Qinghai-Xizang Exped. Vegetation Group 034 (holotype of *Paeonia veitchii* Lynch var. *uniflora* K. Y. Pan, PE [14b]).
- Qiu, J. Z. PB88034 (holotype of *Paeonia qiui* Y. L. Pei & D. Y. Hong, PE [7]).
- Reuter s.n. 14,15,16 May 1841 (lectotype of *Paeonia broteri* Boiss. & Reut., G; isoelectotypes, BM, G, K [18]); s.n. 2 Sep. 1841 (lectotype of *Paeonia microcarpa* Boiss. & Reut., G [32e]) and s.n. 1841 (syntype of *Paeonia microcarpa* Boiss. & Reut., G [32e]).
- Reverchon, E. 218 (holotype of *Paeonia russoi* Biv. var. *reverchonii* Legrand, P; isotypes, BM, F, G, K, M, P, WU [17]).

- s. coll. 97, 29 Apr. 1876 (Com. Mr John Ross 10/77) (lectotype of *Paenonia oreogeton* S. Moore, K [15]).
- s. coll. s.n. FRANCE, "Monte Serane" (lectotype of *Paenonia paradoxa* G. Anderson var. *leiocarpa* DC., G [32e]).
- Shen, B. A. PB1018 (isotype of *Paenonia ostii* T. Hong & J. X. Zhang var. *lishizhenii* B. A. Shen, PE [5]).
- Sieber s.n. CORSICA, "monte Cagna ad Porto vecchio in Corsica" (holotype of *Paenonia corsica* Sieber ex Tausch, P; isotype, K [17]); s.n. 1817 (holotype *Paenonia clusii* Stern, K [19]).
- Sintenis 906 (holotype of *Paenonia tenuifolia* var. *parviflora* Huth, BP [27]).
- Sintenis, P. 459 (neotype of *Paenonia arietina* G. Anderson, K; isoneotypes, BM, G [30]).
- Sintensis, P. 334 (neotype of *Paenonia peregrina* Mill., LE; isoneotypes, G, K, P, WU [28]).
- Smith, H. 4641 (holotype of *Paenonia decomposita* Hand.-Mazz., UPS; photo, PE [3]).
- Soleirol s.n. 1822 (holotype of *Paenonia corallina* Retz. var. *pubescens* Moris, G [17]).
- Strobl, P. G. s.n. July 1873 (neotype of *Paenonia flavescens* C. Presl, K; isoneotypes, RO, WU [21d]).
- Tei s.n. 6 May 1935 (holotype of *Paenonia albiflora* var. *trichocarpa* f. *pilosella* Nakai, TI [11]); s.n. 14 June 1936 (holotype of *Paenonia japonica* var. *pilosa* Nakai, TI [15]).
- Thiébaud, J. s.n. 10 Apr. 1932 (lectotype of *Paenonia corallina* Retz. var. *kesrouanensis* Thiébaud, P; isoelectotype, K [23]).
- Trabut, L. s.n. 1888 (holotype of *Paenonia algeriensis* Chabert, P; isotypes, G, P [25]).
- Tzanoudakis, D. 1210 (holotype of *Paenonia mascula* (L.) Mill. subsp. *hellenica* Tzanoud., UPA [21c]) and 2215 (holotype of *Paenonia mascula* subsp. *icarica* Tzanoud., UPA [21c]); 1400 (holotype of *Paenonia parnassica* Tzanoud., UPA; isotypes, BM, E [31]).
- Vergnes s.n. 24 May 1911 (epitype of *Paenonia officinalis* L. var. *mascula* L., P [21]).
- Wallich no. 4727 (holotype of *Paenonia emodi* Wall. ex Royle, K; isotypes, BM, E, G, P [12]).
- Wilson E. H. 1333 (holotype of *Paenonia delavayi* var. *angustiloba* Rehder & E. H. Wilson, A [2]); 3034 (holotype of *Paenonia veitchii* Lynch, K; photo, PE [14b]).
- Wittmann s.n. May 1840 (holotype of *Paenonia wittmanniana* Steven, LE [20c]).
- Woronow, G. s.n. 16 May 1904 (neotype of *Paenonia abchasica* Misch. ex Grossh., LE; isoneotypes, G, M [20g]).
- Ying, T. H. 1007 (holotype of *Paenonia altaica* K. M. Dai & T. H. Ying, SHMU; isotype, PE [14]).
- Yü, T. T. No. 8143 (holotype of *Paenonia yunnanensis* W. P. Fang, KUN [8a]); 8223 (holotype of *Paenonia yui* W. P. Fang, KUN; isotype, PE [11]).
- Zhang Q. R. 19920517 (neotype of *Paenonia suffruticosa* subsp. *rockii* S. G. Haw & Lauener var. *linyanshanii* Halda, PE [4a]).

B. NON-TYPE SPECIMENS

- Abai 12657 (W [20e]).
- Abaschidze s.n. 23 May 1965 (LE, TBI [20b]).
- Abramov s.n. 29 June 1938 (LE [20c]).
- Abrams, L. R. 3112 (F [10]), 3601 (CAS [10]) and 12416 (CAS [9]).
- Abrosimova, G. A. & Matzenko, A. E. 233 (LE [11]).
- Acad. Sin. Bot. Inst. Exped. to Xinjiang 1803 (PE, XJBI [26]).
- Acad. Sin. Exped. 10402 (PE [26]).
- Acad. Sin. Huanghe Exped. s.n. 14 Aug. 1956 (PE [11]).
- Acad. Sin. Nat. Resources Exped. 75–247 (PE [12]).
- Acad. Sin. Xinjiang Branch 012 (XJBI [14a]) and 2496 (PE, XJBI [14a]).
- Acad. Sin. Xinjiang Branch, Integrated Inst. Hydr. Ped. & Biol. 5915 (XJBI [26]).
- Acad. Sin. Xinjiang Integrated Exped. 10227 (PE [26]) and 10657 (PE [26]).
- Achundov & Sulejmanov s.n. 5 May 1960 (BAK [20e]).
- Achundov, T. F. s.n. 3 July 1962 (BAK [20e]).
- Adamovic s.n. (WU [20a]).
- Adamovic, L. s.n. 20 May 1894 and s.n. 20 May 1903 (G [28]), s.n. 11 May 1896 (B, WU [28]), s.n. 20 May 1900 (E [28]), s.n. 05.1894 (B [28]), s.n. 3 May 1896 and s.n. 11 May 1896 (WU [28]).
- Adams, H. 74-667-1 (CAS [9]).
- Adzinba & Chitanova s.n. 27 Aug. 1987 (LE [20g]).
- Aedo, C. et al. 1078 IA (MA [18]); 1077 IA, CA2367 and s.n. 27 May 1991 (MA [32e]).
- Aedo, C. s.n. 14 Apr. 2001 (MA [18]), s.n. 25 Apr. 1991 and s.n. 29 July 1991 (MA [21a]).
- Aedo, Muñoz-Garmendia & Navarro, C. CN-445, CN-520 and CN-521 (MA [24]).
- Ahman, Y. 138 (E [21a]).
- Ahn, J. H. s.n. 19 July 1969 (SNU [15a]).
- Aidarova & Kashenko s.n. 18 July 1954 (LE [26]).
- Akeroyd, J. R. 3477 (BM [21d]).
- Akhani 4381 (M [20e]).
- Akinfiew s.n. Apr. 1897 (LE [20b]).

- Akman*, Y. 8000 (ANK [23]).
- Albo*, G. s.n. 4 May 1933 (MA [18]).
- Albov*, N. 229, 252, 255 and 318 (G [20c]), 289, 430 and 607 (G [20g]).
- Albury*, *Cheese & Watson* 3160 (K [20c]), 3309 (K [30]).
- Alejandre*, J. A. & *Escalente*, M. J. 00–712 (MA [21a]).
- Alejandre*, J. A., *Arizaleta*, J. A. & *Benito Ayuso*, J. 97–366 (MA [21a]).
- Alexandrov*, P. 179, 219 (LE [14a]).
- Alice*, D. & *Godman*, C. & E. s.n. Apr. 1933 (BM [17]).
- Almeda*, F. & *Copp*, J. 6560 (CAS [10]).
- Almeda*, F. & *Erisendardt*, R. 7420 (CAS [9]).
- Alston*, A. H. G. & *Sandwith*, N. Y. 1775 (BM, K [29]).
- Altad Shah* 29091 (E [12]).
- Ambrosetti*, R. 3193 (A [10]).
- Amosov*, A. 375 (LE [15a]).
- Amott*, W. s.n. 1825 (E [32c]).
- Andreanszky* s.n. 13 May 1928 (BP [24]).
- Andreev* s.n. 19 May 1960 (LE [27]).
- Andreev*, K. A. 364, 444 (LE [15a]).
- Andreev*, V. 74 (LE [14a]).
- Anthouard*, L. s.n. May 1879 and s.n. June 1879 (K [32c]), s.n. 8 May 1877 and s.n. 7 July 1879 (BM [32e]), s.n. May 1878 and s.n. June 1878 (G [32e]).
- Antonio*, A. & *Brita*, R. s.n. 27 Mar. 1956 (COI [18]).
- Anxian Exped.* 225 (SM [22]).
- Aparicio*, A. & *Balzquez*, J. TF 8768 (MA [24]).
- Aparicio*, A. & *Rowe*, J. G. s.n. 18 Aug. 1983 (MA [24]).
- Applegate*, E. I. 907 (CAS, US [9]) and 2155 (US [9]).
- Arampatzis*, T. & *Vidakis*, K. s.n. 27 May 1996 (UPA [20a]).
- Arbesser* s.n. May 1911 (GZU [32a]).
- Aswal*, B. S. 11983 (F, G [12]).
- Atchley*, S. C. 1355 (K [19a]), 2000a and 2000b (K [31]).
- Atmanskikh*, Z. s.n. June 1912 (LE [20b]).
- Aucher-Eloy* 4019 (BM, G [20a]).
- Augustinowicz* s.n. 9 July 1872 (LE [11]).
- Augustinowicz*, O. s.n. 1 June 1872, s.n. 17 June 1872 and s.n. 6 June 1880 (LE [15a]).
- Austin*, R. M. 144 (MO [9]).
- Ayasse*, E. s.n. 3 May 1858 and s.n. 11 May 1858 (G [32c]), s.n. 15 Apr. 1873 (G [32e]).
- Aznavaur*, G. V. s.n. 21 May 1907 (G [28]).
- Bacigalupi*, R. 3077 (US, W [10]).
- Bai*, J. L. 8613 (NWTC [14b]).
- Baicheng Group* 246 (PE [11]).
- Baker*, C. F. 899 (F, MO, US [9]).
- Baker*, G. P. s.n. 26 May 1941 (K [21a]).
- Baker*, H. A. 735 (A [9]).
- Baker*, M. S. 11657 (A [9]).
- Baker*, W. H. 4055 (CAS [9]).
- Balansa*, B. s.n. 1 June 1857 (G [28]).
- Baldacci*, A. 53 (BM, WU [28]), 222 (BM [28]) and s.n. 13 June 1896 (P [28]).
- Ball*, J. s.n. 26 June 1951 (K [18]).
- Balls*, E. K. 14736, 14774 and 14795 (A [9]), 8191 and 11391 (A [10]).
- Balls*, E. K. & *Everett*, P. C. 22874 (A [10]).
- Balls*, E. K. & *Gourlag*, W. B. 1723 (K [30]).
- Banafons*, V. s.n. 28 May 1891 (BM [32c]).
- Banks*, D. L. & E. H. 0932 (F [10]).
- Banks*, D. L. & *Moreno*, J. 1260 (F [10]).
- Banks*, D. L. & *Steinmann*, V. 1902 (F [10]).
- Banzragch*, D. et al. 4249 (LE [14a]).
- Banzragch*, D. & *Dugar*, T. 364 (LE [14a]).
- Banzragch*, D., *Karamysheva*, Z. V., *Munkhbayar*, S. & *Tzhegmid*, T. 4583 and 4947 (LE [14a]).
- Banzragch*, *Gambold*, *Mumbayar* & *Damba* 5667 (LE [14a]).
- Bao*, S. Y. 151, 250, 302 and 2148 (PE [15b]).
- Baranda*, J., *Muñoz-Garmendia*, F., *Navarro*, C. & *Telleria*, T. s.n. 8 June 1991 (MA [21a]).
- Barbey*, W. s.n. 21 Apr. 1877 (G [21a]).
- Barelay*, S. C. 13 (K [19a]).
- Barnabishvili* s.n. Aug. 1935 (TBI [20c]).
- Barth*, J. s.n. 25 Apr. 1876 (B, BP, GZU, RO, WU [27]) and s.n. 1878 (B [27]).
- Bartholomew*, B. 6708 and 6815 (CAS [9]).
- Bartholomew*, B. & *Anderson*, B. 4368 and 4686 (CAS [9]).
- Bartholomew*, B. & *Sun*, H. 8838 (PE [9]).
- Baschant* s.n. 20 June 1937 (B [27]), 1054 (B [32a]).
- Bastl*, L. s.n. 19 May 1985 (GZU [16]).
- Battandier*, J. A. s.n. June 1914, s.n. May 1917, s.n. ALGERIA, Constantine Prov. and s.n. ALGERIA, Constantine Prov. near Kefrida (MPU [25]).
- Bayanova*, V. P. 150 (LE [11]).
- Bayer*, E. & *Grau*, J. B. G. 258 (M [24]).
- Beauverd*, G. s.n. May 1927, s.n. 20 Apr. 1935 and s.n. 16 May 1937 (G [32c]).
- Becherer*, A. s.n. 5 June 1930 (G [32c]).
- Becker* 4804 (BP [27]).
- Behrendsen* s.n. 24 June 1903 (B [32a]).
- Beichuan Exped.* 190 (SM [22]).
- Beijing Team* 2378 (PE [15a]).
- Bellot & Ron* s.n. 13 June 1965 and s.n. 13 May 1970 (MA [32c]).
- Belousov*, V. s.n. 4 July 1913 (LE [15a]).
- Beltran*, F. 4 (B [18]).
- Bennet* s.n. 15 May 1873 (K [21a]).
- Benson*, L. 4523 (A [9]), 3178 and 4276 (A [10]).
- Bentham* s.n. ITALY, Trieste (K [32a]).
- Bernard* 80 and 112 (G [17]).
- Besser*, W. s.n. UKRAINE, Aluschda, Welder des Tschatyr-Dagh (E, K [20a]).

- Betono, B. Fz de & Alejandre, J. A. 1217/90 (MA [32e]).
Beyrouth s.n. FRANCE, Pyrenees Or.: Collioure (G [32e]).
Bicknell, C. s.n. 8 May 1899 (BM [16]).
Bijie Exped. 984 (HGAS, K, PE [15a]).
Billot, C. s.n. 19 May 1862 (BM, G [32c]), 3305 (B [32e]).
Biology Exped. 79250198, 81-8330478 and 81-8381574 (XJBI [26]).
Biskam 2330 (E [12]).
Bissing, D. R. 56 (A [10]).
Blagoveshchensky, N. V. & Poplavskaya, G. I. 244 and 1566 (LE [11]).
Blanca, G. & Valle, F. s.n. 10 June 1980 (MA [24]), s.n. 10 July 1980 (MA [32c]).
Blanpin, A. & Lizeau, P. A. AC-22133 (G [32e]).
Bobrov, A. E. & Tzvelev, N. N. 893 (LE [20c]).
Bochantsev, V. 547 (LE [26]).
Bochantsev & Egorova 1014 (LE [26]).
Bocquet, G. 10472 (BM [24]).
Bohatsch, F. s.n. 14 Apr. 1874 (BP [32b]).
Boivin s.n. 1832 (G [32c]).
Bonneau, J. L. A. s.n. FRANCE, Herault: Montpellier, Pic St. Loup (G [32c]).
Bontigny s.n. 3 June 1860 (G [32c]).
Borbas s.n. Apr. 1874 and s.n. 31 May 1874 (BP [32b]).
Borbas, V. s.n. 19 Apr. 1873 (WU [27]).
Boros, A. s.n. 9 May 1958 and s.n. 10 May 1958 (BP [32b]).
Borovikov, G. s.n. 13 June 1909 and s.n. 8 Aug. 1910 (LE [14a]).
Botis, O. de s.n. 22 Apr. 1968 (BC [18]).
Bottun, E. 70 (IDS [9]).
Bourgeau E. s.n. 16 May 1869 (K, P [16]), 1755 (BM, K [18]), s.n. 1854 and s.n. 22 July 1863 (BM [18]), s.n. 2 June 1853 (K, W [18]), s.n. 17 May 1850 and s.n. 27 July 1850 (E, K [18]), s.n. Pardo, Escorial (WU [18]), s.n. May 1970 (G [19b]), s.n. 11 June 1870 (BM, F, G, P, US [19b]), 10052 (P [24]), s.n. June 1852 (E [24]), s.n. 29 June 1849 (BM [24]), s.n. 16 May 1862 (BEO, BGUB, E, P [30]), s.n. 22 July 1863 (BM [32c]).
Bowen, J. G. E. s.n. July 1976 (K [30]).
Boyd, S. & Raz Lauren, 9273 (CAS [10]).
Brândză, G. s.n. 20 May 1902 (P [28]).
Branth s.n. 4 June 1847 (LE [14a]).
Breedlove, D. E. 3611 (CAS [9]), 2158 (CAS [10]).
Brinton-Lee, D. 454 (BM [18]).
Briquet s.n. 27 Apr. 1908 (G [21d]).
Brookes, W. P. 551 (KYO [15a]).
Brotero F. de Avellar, F. 48 (WU [18]).
Broussalis, P. s.n. 14 Apr. 1973 (ATH [21a]).
Brown, C. s.n. 13 Jan. 1929 (A [10]).
Brown, H. E. 564 (F, US [9]).
Brummitt, R. K., Hunt, D. R. & Leistner, O. A. 5199 (K [21d]).
Brunner, J. s.n. 5 June 1969 (GZU [32a]).
Brylkin s.n. 1860 (LE [15a]).
Bubani, P. s.n. 9 June 1836 (G [32c]), s.n. 1 June 1837 (G [32e]).
Bucalovie s.n. May 1912 (BM [30]).
Buia, A., Paun, M., Cirtu, D. et al. s.n. (BM, BUCA, G, PE [28]).
Bujanova, Z. 6, 8 (LE [11]).
Bulavkina, A. 1408 (LE [11]), 142 (LE [15a]), 356 and s.n. Primorsky Prov., America Bay, Nakhodka (LE [11]).
Bunge s.n. Apr. 1858 and s.n. May 1858 (K, P [20e]).
Bunge, H. D. s.n. Aluschda, Welder des Tschatyr-Dagh (P [20a]).
Burdukova, A. s.n. 25 June 1925 (LE [14a]).
Burnat, B. s.n. 6 June 1889 (G [28]).
Burnat, E. s.n. 7 June 1865 (WU [32a]).
Burnouf, C. s.n. 5 May 1878 (WU [17]).
Burri, W. & Krendl, F. s.n. 3 July 1987, s.n. 27 July 1987, s.n. 4 May 1990 and s.n. 5 May 1990 (W [19a]).
Burt, B. L. & Arshad Ali, M. B854 (E [12]).
Busch s.n. 24 Aug. 1929, s.n. 19 Aug. 1930, s.n. 24 June 1936 and s.n. 5 July 1937 (LE [20c]).
Busch, N. A. s.n. 1 May 1905, s.n. 4 May 1905 and s.n. 10 May 1905 (LE [20a]).
Busch, N. s.n. 4 May 1905 (BP, G, WU [27]).
Busch & Klopotov s.n. 16 Apr. 1907, s.n. 21 Apr. 1907 and s.n. 25 Apr. 1907 (LE [20b]), s.n. 11 May 1907 (E, LE [20b]), s.n. 21 Apr. 1907 (LE [27]).
Bush, A. E. s.n. 1880 (US [10]).
Butler, G. D. 1229 (A, CAS, MO [9]).
Bykov, M. 9 (LE [15a]).
Bykov, N. 8 (LE [11]).
Cabezudo, B. et al. 1431/75 (MA [18]).
Cacciato, A. s.n. May 1932 (RO [21d]).
Callier, A. 770 (B, G, WU [27]), s.n. 8 June 1895 and s.n. 14 Apr. 1900 (WU [27]).
Campell, M. S. & Steuger s.n. 11 May 1938 (BM [32c]).
Cantelow, H. C. 301 (CAS [9]).
Cao & Cheng H01032 (A, K, MO, PE [11]), H01033 (A, BM, CAS, K, MO, PE [15a]).
Carneiro, A. de B. 182 (COI [32e]).
Carrien s.n. July 1835 (G [17]).
Carriso & Mendoça s.n. 4 June 1930 (COI [32e]).
Carnel, J. s.n. 19 Apr. 1857 (K [21a]).
Casaseca, B. s.n. 21 Apr. 1962 (MA [18]).
Castelli, C. s.n. 15 June 1886 (RO [32d]).
Castro, J. A. A. s.n. May 1887 (WU [18]).
Castroviejo, Casaseca & Carrasco 12665 SC (MA [18]).
Castroviejo, S., Fdez Casas, J., Muñoz-Garmendia, F. & Susanna, A. FC4885 and FC5403 (G, MA [24]).

- Ceballos, L. s.n. 15 May 1931 (MA [18]), s.n. 1 June 1933 (MA [32e]).
- Černjavsk, P. s.n. 9 June 1925 (BEO [20a]), s.n. 16 June 1925 and s.n. 30 May 1927 (BEO [28]).
- Chaffanjon, M. T. s.n. 23 Apr. 1895 (G [14a]).
- Chambers, K. L. 004 (CAS [10]).
- Chang, C. W. 11356 (XJBI [14a]).
- Chang, C. W. et al. 4357 and 10255 (XJBI [14a]), 3316 and 4037 (XJBI [26]).
- Chapman, E. 26370 (K [21a]).
- Charpin, A. 20995 (G [18]).
- Charpin, A. et al. AC 17795 (E, G [17]).
- Charpin, A. & Di-Hrich, M. AC-18089 (G [21d]).
- Charpin, A. & Fdez Casas, J. s.n. 20 July 1974 (MA [24]).
- Charpin, A. & Greuter, W. 8289 (G [32c]).
- Charpin, A., Fdez Casas, J., Jacquemoud, F. & Jeanmonod Mar, D. 837 (G, MA [24]).
- Chater, A. O. 208 (BM [27]).
- Chaudhri, M. N. et al. 34 (W [12]).
- Chen & Ju s.n. 17 July 1987 (NWTC [14b]).
- Chen, D. Y. s.n. CHINA, Yunnan: Weixi (CPB [2]).
- Chen, J. R. 86103 (PE [14a]).
- Chen, L. 086 (ZJFC [15a]).
- Chen, Q. L. et al. 1920 (PE [15b]).
- Chen, S. L. 0040 (PE [26]).
- Chen, T. & Ma, L. M. PB86008, PB86009, PB86010, PB86011, PB86016 and PB86017 (PE [4a]), PB86012, PB86013, PB86014 and PB86015 (PE [7]).
- Chen, W. L. H98040 (A, K, MO, PE, US [15b]).
- Chen, Z. A. 99 (IFP [15a]).
- Chengde Exped. 35 (PE [15a]).
- Cherepnin s.n. 16 June 1959 (LE [14a]).
- Chernov, E. 3 (LE [14a]).
- Chernovol s.n. 1 Aug. 1946, s.n. 15 June 1986 and s.n. 25 June 1986 (LE [20b]).
- Chersky, A. I. s.n. 29 May 1911 (LE [15a]).
- Chersky, A. & Cherskaya, M. s.n. 13 June 1909 (LE [11]).
- Chesnokoff s.n. RUSSIA, Chitinsky Prov. Nerchinsk (LE [11]).
- Chevignard, C. s.n. 13 June 1874 (K [21a]) and s.n. 1847 (P [21a]).
- Ching, R. C. 20438, 20595, 22192, 22954, 24191, 24365, 30071, 30175 and 30987 (KUN, PE [2]), 1803 and 2496 (PE [14a]), 2433 (PE [26]).
- Chodat, S. R. 712 (G [18]).
- Chou, T. Y. 652100 (XJBI [26]).
- Chou, T. Y. et al. 650392 (PE [26]), 650868 and 652150 (PE, XJBI [26]).
- Chow, H. F. 40669 (PE [15a]).
- Chü, K. L. 1621 (PE [15a]), 2400 and 2407 (PE [22]).
- Chuan-Econom. A (59) 2011 (PE, SZ [15b]).
- Chuan-Econom.-Liang (59) 3597 and (59) 3710 (PE, SZ [15a]).
- Chung, T. H. 10003 and s.n. 13 Aug. 1981 (SNU [11]), 10010 (SNU [15a]).
- Clare, T. s.n. 3 Mar. 1929 (A [10]).
- Clark, O. M. 1963 (A [10]).
- Clokey, I. W. & Templeton, B. 4447 (A, F [10]).
- Constance, L. & Beetle, A. A. 2532 (CAS [10]).
- Constance, L., Clarke, J. F. G., Staats, W. & Vleet, G. Van 1217 (MO [9]).
- Constance, L., Dyal, S. C. & Packard, J. 1870 (US [9]).
- Constanfrinid & Cretzoiu, P. s.n. 24 Apr. 1938 (G [27]).
- Coode & Yaltirik D38613 (E [28]).
- Coode, M. J. E. & Jones, B. M. G. 443 (E [20a]), 2732 (E [30]).
- Cooke 16084 (F [9]).
- Cooper, N. C. 2025 and 3623 (A [10]).
- Cosson, E. s.n. 21 June 1880 and s.n. 1 July 1880 (K, P, US [25]), s.n. 19 July 1961 (P [25]).
- Coste & Segret s.n. Apr. 1914 (G [21a]).
- Cousturier, P. s.n. May 1917 (G [17]), s.n. June 1918 (G, P [17]), s.n. June 1917 (K [17]), s.n. Apr. 1914 (G [19a]).
- Cox s.n. 4 June 1886 (BM [32a]).
- Crane, B. s.n. 12 June 1936 (MO [9]).
- Crawford, F. C. s.n. 11 May 1905 (E [32a]).
- Cretzaiu, P. & Neuwirth, J. s.n. June 1933 (BUCA [28]).
- Cretzaiu, P. s.n. 15 May 1932 (G [28]).
- Cronquist, A. 2508 and 2746 (IDS, MO [9]), 5767 and 6380 (US [9]), 6651 (US, W [9]).
- Crow, E. 151 (A [10]).
- Cuatrecasas s.n. 23 June 1925 and s.n. 19 Oct. 1925 (BC [18]).
- Cubas, P. et al. 007 MG (MA [18]).
- Cui, N. R091 and 86624 (XJNU [14a]), 848 (XJBI [26]).
- Cui, S. C. et al. 270 (IFP [15a]).
- Cui, Y. W. 4348 and 10281 (PE [14b]).
- Cunha, A. R. da 125 (COI [18]).
- Čurčič, V. s.n. June 1898 (K [32b]).
- Curtis, 193 (E [28]) and 116 (E [30]).
- D.L. 97076 (PE [4a]).
- Daenen s.n. 1864 (G [21a]).
- Dai, Li & Tang 64-1, 64-2, 64-3, 64-4, 64-6, 64-7, 64-17 and 64-27 (CPB [2]).
- Dai, T. L. et al. Dawu 64-3 (SM [14b]).
- Dai, T. L. & Xu, L. G. DAN66-1 (SM [2]).
- Dai, T. L. 101441 (PE, SZ [15b]).
- Dai, T. L., Li, R. H. & Tang, G. H. 64-7, 64-10 and 64-33 (PE [3b]), 64-8 and 64-14 (SM [14b]).
- Dai, Z. L. 2005001 (PE [8]).
- Danilov, S. I. s.n. 17 June 1933 and s.n. 23 Aug. 1932 (LE [11]).
- Danilov, S. s.n. 10 Sep. 1932 (LE [15a]).
- Daocheng Division 2397 (PE [2]).

- Dashnyam*, B. s.n. 27 Aug. 1963 (LE [11]).
- Davazhamtz*, T. s.n. 11 July 1952 (LE [14a]).
- Daveau*, J. s.n. Mar. 1877 (BM [18]), s.n. July 1885 and s.n. Apr. 1886 (COI [18]), s.n. Apr. 1885 (G [18]).
- Davidson*, C. 2587 (A [9]), 1805 (A [10]).
- Davis & Hedge* D27104 (ANK [20a]), D26879 and D27159 (ANK, BM, K [21a]), D29299, D31105 and D31990 (BM, E [30]), D31467 (BM, E, K [30]).
- Davis & Polunin* 24808 (K [30]).
- Davis* 40312 (E [19b]), 33373 (E, G, K, LE [20a]), 54831 (BM [24]), 52593 (BM [25]), 22240 (BM, E, K [30]), 44322 (E, K [30]).
- Davis, D. & Sutton*, S. 63828, 63835, 64262 and 64405 (BM [21d]).
- Davis, H. W.* s.n., 16 May 1946 and s.n. 27 Apr. 1945 (IDS [9]).
- Davis, P. H.* 18062 (K [19a]), 192 (BM [19a]), 14287 (K [20a]), 1639 and 45045 (E [21a]), 15711 and 46082 (K [21a]), 3067, 3508, 15199 and 41775 (E, K [21a]), 40140 (E, LD [21d]), 6299 (E, K [23]).
- Davis, P. H. & Hedge* 27158 (BM, K [23]).
- Davis, P. H. & Polunin*, O. 24603 (ANK, BM [21a]).
- Davis, R. J.* 4155, 4498 and 4626 (IDS [9]).
- Davitadze* s.n. GEORGIA, Adjaria: Beschumi (BATU [20c]).
- Davlianidze* 1460 (TBI [20g]).
- Davlianidze & Kapanadze* 1434 (TBI [20g]).
- Debeaux*, O. s.n. 2 May 1869 (BM [17]).
- Dešov, A.* s.n. 22 July 1928 (LE [14a]).
- Degen, A. de* s.n. 9 June 1887 (WU [27]), s.n. 9 June 1887 (E [32b]), s.n. 1888 (K [32b]).
- Demiriz, H.* 929 (E [21a]), 5056 (E [28]).
- Deng, H. & Yuan, Y. H.* s.n. 20 May 1957 (PE [15a]).
- Deng, M. P.* 4009 (PE [15a]).
- Deng, Y. C.* 181 and 798 (IFP [15a]).
- Derbek, F. A.* s.n. 8 June 1910 (LE [15a]).
- Desoulavi, N. A.* 283 (LE [15a]).
- Desoulavy, N.* 105, 1155 and 1371 (LE [11]), 85 and 1369 (LE [15a]).
- Desoulavy, N. A.* 284 (LE [15a]).
- Desoulavy, P.* 3591 (LE [15a]).
- Desplantes, G.* s.n. May 1934 and s.n. May 1937 (B [17]), s.n. May 1937 (GZU, WU [17]), s.n. 22 June 1826, s.n. 22 May 1827, s.n. 20 May 1831, s.n. 23 May 1833, s.n. 22 May 1837 and s.n. May 1837 (B [21a]), s.n. June 1838 (B [32c]).
- Desyatkin, N. L.* 449 (LE [14a]).
- Deverall & Flannigan* 0409 (E [18]), 0408 and 0413 (E [32e]).
- Dihoru, G. & Donita, N.* s.n. 9 May 1960 (BUCA [28]).
- Dihoru, G.* s.n. 14 Apr. 1959 (BUCA [20a]), s.n. 2 May 1960, s.n. 12 May 1960, s.n. 17 June 1960 and s.n. 20 June 1960 (BUCA [28]).
- Diklić, N. & Nikolić, V.* s.n. 26 July 1979 (BEO [20a]).
- Dimonie* s.n. Apr. 1909 (G, WU [28]).
- Dinsmore, J. E.* 20001 (K [21a]).
- Diomete* s.n. 5 June 1876 (BM [32c]), s.n. 7 June 1876 (BM [32e]).
- Dixon, J.* 802 (US [9]).
- Dmitrieva* s.n. 21 May 1962 (LE [20c]).
- Dobes, C. & Vitek, E.* 98-1229 (W [32e]).
- Dobrescu, C.* s.n. 5 May 1948 and s.n. 17 Aug. 1948 (BUCA [20a]).
- Dobroczejewa, D.* s.n. 23 May 1952 (PE [27]).
- Dokturovsky, W.* 5523, 5651 and 5654 (LE [15a]).
- Dolenko, G.* 108 (LE [14a]).
- Dolmatova et al.* 935 (LE [20g]), 1877 and 1997 (LE [27]).
- Dolukhanov* s.n. 3 Aug. 1958 (TBI [20c]).
- Dolukhanov, A.* s.n. 28 June 1948, s.n. 13 May 1954 and s.n. 29 May 1954 (TBI [20d]).
- Dolukhanov & Kazarova* s.n. 31 July 1955 (TBI [20g]).
- Dolukhanov, A. & Kazarova, A.* s.n. GEORGIA, Adjaria: Adjaro-Guria Gorge, Nagvarevis- Khevi to Gomis-Mta Pass (TBI [20c]).
- Dongling Exped.* 269 (PE [15a]).
- Dorda, E. et al.* s.n. 11 June 1987 (MA [18]).
- Dorfler, I.* 81 (WU [32d]).
- Dorofeyuk, N. I.* 304 (LE [14a]).
- Dorsett, P. H. & Dorsett, J. H.* 349 (PE [11]), 4142 (PE [15a]).
- Downen, R.* 102 (MO [9]).
- Dranitsyn & Kochubei* s.n. 26 May 1910 (LE [14a]).
- Dressler, R. L.* 555 (A [10]).
- Druce, G. C. & Lodge, Y.* s.n. CYPRUS, Troodos Mts: Prodhromos (E [21a]).
- Dudley* D34799 (E [30]).
- Duffour, C.* s.n. May 1916 (B, G [32c]).
- Dunford, G. & Moyes, E. G.* 137 (BM [17]).
- Duthie* s.n. 18 June 1872 (E [32a]), s.n. 21 June 1872 (BM [32a]).
- Dylis, N.* 195 (LE [14a]).
- Dyukina, N.* s.n. 12 June 1913 (LE), 289 and 322 (LE [15a]).
- Dyukina, N. V.* 470, s.n. 30 May 1909 and s.n. 9 June 1909 (LE [11]).
- Eastwood, A. & Howell, J. T.* 8117 (A, CAS [9]).
- Eastwood, A.* 362 (CAS [9]), 2852, 14957 and 16832 (CAS [10]), s.n. 21 Apr. 1908 (F [10]).
- Eavran* s.n. 1892 (E [32c]).
- Edge, J. B.* s.n. 11 Feb. 1934 (A [10]).
- Edinburgh Bot. Gard. Exped.* 85-6 (E, KUN [2]).
- Edmonds, M. E.* 228 (K [16]).
- Edmondson, J. R. & McClintock, M. A. S.* E2884 (E [21a]).
- Eggleston, W. W.* 11368 and 14124 (US [9]).
- Egorova, E. M. & Sharomova, E. A.* 3994 (LE [15a]).

- Elias, T. S., Webber, W., Tomb, C. S. & Krasnoborov, I. M. 4232 (PE [26]).
- Engelhardt s.n. 14 May 1882 (B, K [32a]).
- Engelhardt, V. s.n. 24 July 1883, s.n. 27 July 1884, s.n. 8 May 1895 and s.n. 22 May 1922 (B [32a]), s.n. 4 May 1886 (B, GZU [32a]), s.n. 10 May 1887 (GZU [32a]), s.n. 12 May 1888 (BC, GZU [32a]), s.n. 20 May 1888 (BM [32a]).
- Enwald, R. & Knabe, C. A. s.n. 3 July 1880 (G, K [14a]).
- Ermolajeva, M. s.n. 25 May 1914 (LE [14a]).
- Ernesto Felix s.n. Apr. 1980 (MA [16]).
- Estrada, J. s.n. 27 July 1984 (MA [18]).
- Evers 200, 201 and 202 (WU [32a]), s.n. 21 May 1886 and s.n. 30 May 1898 (BM, GZU [32a]), s.n. 14 June 1897, s.n. 6 June 1898, s.n. 30 Apr. 1902 and s.n. 13 May 1902 (GZU [32a]).
- Everson, A. C. s.n. 8 May 1946 (IDS [9]).
- Evseeva, Z. 4406 (LE [14a]).
- Fabregat, C. s.n. 11 July 1987 (MA [32e]).
- Falconer 77 (P [12]).
- Fang, W. P. 4213 and 6037 (PE [14b]), 1081 (PE, SZ [15a]).
- Fang, Z. F. 2285, 3564 and s.n. CHINA, HEBEI, Xinglong: Mt Wuling, Lianhuachi (IFP [15a]).
- Farges, R. P. 566 (LE [15b]).
- Fauconnet, C. s.n. FRANCE, Herault: Montpellier (G [32e]).
- Faure, A. s.n. 17 June 1894 (G [32c]).
- Faurie 460 and 468 (LE [15a]).
- Faurie, U. 1711 (E [15a]).
- Fdez Casas, J., Muñoz-Garmendia, F., Susanna, A. & Telleria, M. T. FC7131 (G, MA [24]) and FC7255 (G [24]).
- Fedchenko s.n. 1893 (G [27]).
- Fedchenko (Fedtschenko), B. A. 540 (LE [11]), 798, 1073 and 1184 (LE [15a]).
- Fedchenko (Fedtschenko), O. & B. s.n. June 1892 (LE [14a]), s.n. 11 June 1893 (G [20a]).
- Fedorov s.n. 2 June 1952 (LE [27]).
- Fedorov & Iljina 72 and 128 (LE [26]).
- Fedorov, A. & A. s.n. 21 July 1929 (LE [20g]).
- Fedorovsky, V. 1 (LE [11]).
- Fei, Sun, Li & Bai 145 (PE [13]) and 244 (KUN [13]).
- Fellman, N. I. s.n. 1863 (G, K [14a]).
- Feng, K. M. 21245 and 22229 (KUN [2]), 885, 938, 1387, 4220, 5765, 23029 and 23561 (KUN, PE [2]).
- Ferguson, I. K. 1697 (BA [18]).
- Ferguson, L. F. 3067 and 3069 (BM [16]).
- Fernandes, A. & R. & Matos, A. 4141 and 14667 (COI [32e]).
- Fernandes, A. & R. & Matos, Y. 3637 (BM, COI [18]), 6445 and 8600 (COI [18]).
- Fernandes, A. & R. & Paiva, J. 9468 (COI [18]).
- Fernandes, A. & Sousa, F. 1586, 1612 and 1915 (COI [18]).
- Fernandes, A., Matos, Y. & Cardoso, F. 7748 (COI [18]).
- Fernandes, A., Sousa, F. & Matos, Y. 4000 (BM, COI [18]) and 4144 (COI [18]), 3766 (COI [32e]) and 4072 (COI, MA [32e]).
- Fernandes, R. & Sousa, F. 3463 (COI [18]), 3939 (COI, K [18]), 3461 (COI [32e]).
- Fernandez Casas, F. J. 70 (MA [32e]).
- Fernandez Piqueras, J. 319 (MA [32e]).
- Fernandez, C. & Cobos, J. s.n. 12 July 1985 (MA [32e]).
- Fernández, C. & Gutiérrez Ureña, E. s.n. 26 Apr. 1986 (MA [18]).
- Ferrer, P. 6 (G [16]), s.n. May 1942, s.n. 29 Apr. 1948 and s.n. 29 May 1948 (MA [16]).
- Ferris, R. S. 7580 (CAS [10]).
- Ferris, R. S. & Duthie, R. 233 and 922 (CAS [9]).
- Fiala, F. s.n. May 1897 (B, G, GZU [30]).
- Fiedler, O. s.n. 22 May 1929 and s.n. 24 May 1929 (B [32a]).
- Filarszky & Kümmerle, J. B. s.n. 3 July 1911 (BP [20f]).
- Fiori, A. s.n. 29 Apr. 1904 and s.n. 30 May 1910 (BM, K [30]).
- Fiori, A. & Tiana, S. 1853 (BM, K, RO, WU [17]), s.n. 10 May 1914 (BM, K, RO [17]).
- Firuz-Nia 1178 (W [20e]).
- Fischer s.n. RUSSIA, Terskaya: Caucasus (LE [27]).
- Fitz, K. & Spitzenberger, F. 787 (W [23]).
- Florensky s.n. 17 May 1908 (LE [20b]).
- Foletto s.n. June 1896 (B, GZU [32a]).
- Font Quer s.n. 2 Jan. 1925 (BC [18]), s.n. 11 July 1925 (BC [24]), s.n. 10 June 1914 (BC [32e]).
- Forrest 4352, 5716, 6787, 10062, 12503, 12561, 15162, 16339, 16527, 20458 and 30998 (E [2]).
- Forsyth-Major, C. I. s.n. 14 June 1917 (K [17]).
- Foster, P. C. 354 (MO [10]).
- Foures s.n. 7 May 1903 (G [32c]) and s.n. 12 May 1904 (B, G [32c]).
- Franchet s.n. 11 June 1899 (B [32c]).
- Franchet, A. s.n. 20 Apr. 1881 (K [21a]).
- Frantz, A. I. s.n. 10 Aug. 1913 (LE [11]).
- Frawunda s.n. 7 June 1897 (BP [27]).
- Fridlender, A. H01002 (A, BM, CAS, K, MO, PE [16]), H01008 (PE [16]), H01003 (PE [21a]), H01004 (A, BM, CAS, K, MO, P, PE [21a]), H01004a (PE [21a]), H01007 (PE [32c]), H01001, H01005 (K, MO, PE [32e]) and H01006 (A, CAS, K, MO, PE [32e]).
- Froneili s.n. 1909 (BM [32d]).
- Fu, D. Z. 84220 (PE [22]).
- Fu, K. J. 4441 (PE [14b]).
- Fu, K. T. 2584 and 3412 (PE [4b]), 3411 (PE [11]), 2583 (PE [15b]).

- Fu*, P. Y. 2948 (IFP [15a]).
Fu, P. Y. *et al.* 1267 (PE [15a]).
Fu, P. Y. & *Deng*, Y. C. 2866 (IFP [15a]).
Fu, P. Y. & *Zhao*, D. C. 1285 (PE [11]).
Fu, T. K. 834 (PE [14b]).
Fuertes s.n. 6 May 1975 (MA [18]).
Fujii, S. 164 (KYO [15a]).
Fujita, N. & *Miki*, E. 120 (KYO [15a]).
Fukuoka, N. & *Hotta*, M. 56 and 215 (KYO [15a]).
Fukuoka, N. 7245 and 8061 (KYO [15a]).
Fuping Exped. 3 (PE [15a]).
Furse & *Synge* 805 (K [30]).
Gadardo, M. s.n. 26 June 1917 (BC [32c]).
Gadeceau, E. s.n. 22 May 1893 (BM [32c]).
Gagman s.n. 1889 (LE [27]).
Gagnidze, R. *et al.* s.n. 17 June 1965 (TBI [20g]).
Gagnidze, R. & *Mikeladze*, I. s.n. 29 Mar. 1966 and s.n. 30 Mar. 1966 (TBI [20b]).
Galan Cela et al. 1213 (MA [32c]).
Gallier, A. 526 (BM, E, G, K, P, WU [20a]), s.n. 18 June 1895 (WU [20a]).
Gandoger, M. s.n. May 1915 (G [19a]), s.n. 5 July 1878 (G [32c]), s.n. 27 Apr. 1879 (WU [32c]), s.n. May 1898 and s.n. Aug. 1898 (G, K [32c]), s.n. June 1900 (B, GZU [32c]), s.n. July 1902 (M [32c]).
Ganeshin, S. s.n. 12 June 1909 (LE [14a]), s.n. 22 May 1922 (LE [20a]).
Gansu 557 (PE [14b]).
Gansu Herbs Group s.n. 30 Sep. 1971 (NWTC [14b]).
Gansu-Qinghai Exped. 2493 (PE [14b]).
Ganzev, I. s.n. 28 May 1964 (SOM [28]).
Garnett, C.S. G2618 (BM [24]).
Gauba 4 (W [20e]).
Gautier, G. s.n. 11 June 1898 (G [32c]), s.n. 29 June 1881 (BM, M [32c]), s.n. 25 July 1885 (BM, G [32c]).
Gavioli, A. s.n. 4 May 1927 (BAC [21a]).
Gavioli, O. s.n. May 1908 and s.n. 28 May 1933 (BM [21a]).
Gavrilevich s.n. 12 Aug. 1946 (LE [20b]).
Gavronski, C. s.n. RUSSIA, Primorsky Prov.: Barabash (LE [11]).
Gay, J. s.n. FRANCE, Alpes-Maritimes: Caussols, Verignon (K [32c]).
Gebauer, A. K. s.n. 1914 (WU [2]).
Geltman 1476 (LE [27]).
Geltman et al. 1211 (LE [20b]), 1772 (LE [27]).
Geltman, D. et al. 3109, 3193 and 3241 (LE [20g]).
General Exped. 210 and 223 (IFP [15a]).
General Plants Exped. 1252 (PE [15b]).
Genetii, C. & *Engles*, E. 1 (CAS [10]).
Genina, S. s.n. 5 Aug. 1912 (LE [14a]).
Gentry, J. L. & *Davidse*, J. G. 1569 (CAS, MO, W [9]).
Genty, P. A. s.n. 1897 (P [21a]).
Gerold, R. s.n. May 1897 (GZU [32a]).
Gibbs, L. S. 4005 (BM [16]).
Gibbs, P. E. & *Doninguer*, E. D18 (E [18]).
Gibby, M. & *Jemz*, A.C. 12607 (BM [18]).
Gierish, R. K. & *Esplin*, D. H. 3393 (CAS [10]).
Ginzberger, A. s.n. 15 July 1902 (WU [32a]).
Girad, L. s.n. 15 June 1902 (BM [32c]).
Glatz, F. s.n. June 1937 (BP [32b]).
Glehn s.n. 20 June 1860, s.n. June 1860 and s.n. 1 Sep. 1860 (LE [15a]).
Gnadeberg, A. G. 9 (LE [14a]).
Golbek, A. 158 (LE [26]).
Golde, K. s.n. 15 May 1896, s.n. 16 May 1898 and s.n. 28 May 1898 (LE [20a]).
Goldenstadt, 12 (LE [11]).
Goloskokov, V. s.n. 20 June 1956, s.n. 20 June 1959, s.n. 28 June 1959, s.n. 13 May 1963 and s.n. 7 June 1963 (LE [26]).
Golubeva, K. *et al.* s.n. 14 June 1959 (LE [14a]).
Gombault 1726, 1889 and 1994 (P [21a]).
Gontscharow, N. 2051 (LE [26]).
Gordeev, T. P. s.n. 20 June 1915 (LE [11]).
Gorodkov, B. 512 (LE [14a]).
Gorodkov, B. N. s.n. 23 June 1923 (LE [14a]).
Gorovoi, P. G. s.n. 23 May 1964 (LE [15a]).
Goulondris, N. 110 (ATH, BM, E [19a]) and 153 (ATH [19a]).
Govet s.n. May 1828 (G [20a]).
Graells, M. P. s.n. SPAIN, Madrid: Castella, Pardo, Escorial (BM, K [18]).
Grau, J. s.n. 31 June 1966 (M [20f]), s.n. 30 May 1966 (M [32a]).
Grecescu, D. s.n. 10 May 1883 and s.n. May 1888 (WU [28]).
Greene, E. A. L. 755 (F, MO [9]).
Grenia s.n. 1891 (BM [32e]).
Greuter, W. 3508 (W [19a]).
Grey-Wilson & Philips 36 (K [30]).
Grigoriev & Buhaeva 298 (LE [26]).
Grintescu, G. s.n. 13 Apr. 1915 (BUCA [27]).
Grintescu, G. P. s.n. 8 May 1921 (BM, BUCA [28]), s.n. 18 May 1921 (B, BM [28]), s.n. 14 May 1923 (BUCA, G [28]).
Grom, I. s.n. 27 June 1964 (LE [14a]).
Gromova, T. s.n. 18 June 1911 (LE [11]).
Grossheim s.n. 14 May 1935 (BAK, LE [20e]), s.n. 11 May 1946 and s.n. 13 May 1946 (BAK [20e]), s.n. 26 May 1937 and s.n. 30 May 1937 (BAK [27]).
Grossheim et al. s.n. 7 May 1948 (LE [27]).
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Grubov & Luboarsky 229 (LE [26]).

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- Grubov, V. I., Ulzijkhutag, N. & Tzehrehnbalzhd, G. 710 and 787 (LE [11]), 47 (LE [14a]).
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- Grudzinskaya, I. s.n. 1961 (LE [14a]).
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- Guiol, F. 2368 (BM [17]), 2139 (ATH [19a]), 2329, 2396, s.n. Apr. 1935 and s.n. May 1936 (BM [21c]), s.n. GREECE: Mt Athos, Chilanolazi (BM [28]).
- Güner, A. 3842 (E [20c]).
- Güner, A. & Vural, M. AG4922 (ANK [20c]).
- Gunoni s.n. 1825 (G [21d]).
- Guo, B. Z. 6767, 7010, 7396, 10186 and 10232 (HNWP [14b]).
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- Guo & Yang 9608 (HNWP [14b]).
- Gusev 109 (LE [20e]).
- Gviniashvili s.n. 18 July 1980 (LE [20g]).
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- Haines, R. W. 14 (E [21a]) and 959 (E, K [21a]).
- Halliwell, Mason & Smallcombe 1087 (K [18]).
- Halmes, T. H. s.n. 25 Mar. 1932 (A [10]).
- Hamilton, J. F. s.n. 4 June 1887 (E [32a]).
- Hammond, E. W. 12 (MO, US [9]).
- Handel-Mazzetti 2885 and 6969 (WU [2]), 2067 and 8868 (E, WU [2]), s.n. 16 May 1902, s.n. 27 Aug. 1902 and s.n. 16 May 1908 (WU [32a]), s.n. 23 May 1904 (WU [32d]).
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- Hao, C. B. 3067 (HIMC [11]).
- Hao, K. S. 501 (PE [4a]), 604 and 779 (PE [14b]).
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- Harkevich s.n. 29 May 1957 (LE [20c]).
- Harris, S. A. 15814 and 17017 (WU [12]).
- Harrison, A. 35 (A [10]).
- Hashimoto, M. 9818 and 10414 (KYO [15a]).
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- Haynald s.n. May 1860 (BP, G [27]).
- He, X. Y. 22425 (PE [15a]).
- He, Y. H. 96055 (PE [3b]).
- He, Y. Q. 4516 and 4915 (PE [14b]).
- He, Z. 12339 (PE [14b]), 13549 (PE, SZ [15b]), 12388 (PE [22]).
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- Hebei Exped. A 1158 (PE [11]).
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- Hedge, I. C. s.n. 21 Apr. 1968 (BM [19b]).
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- Henderson, Yarkand Exped. 1870 (LE [12]).
- Hengduan Mt Exped. 908, 3180 and 02490 (PE [2]).
- Henry 5365 (E [15b]).
- Herbarium Team 2130 and 2622 (PE [15a]).
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- Herrero, A. et al. AH783 (MA [21d]).
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- Heywood, V. H. 334, 1135, 1175, 1179, 1202, 1485, 1503, 1537 and 1696 (BM [18]).
- Heywood, V. H. & Davis, P. H. 164, 605 and 851 (BM [18]), 779 (BM, E [18]), 754 (BM [24]).
- Hibon, G. s.n. 31 May 1912 (P [25]).
- Hiroe, M. 13154, 14460, 15608 and 18046 (KYO [15a]).
- Hitchcock, C. L. 23533 (CAS [9]), 5995 (A, MO [10]).
- Hitchcock, C. L. & Martin, J. S. 4716 (MO [9]).
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- Hoffman, L. E. s.n. 13 Mar. 1932 (A [10]).
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- Hohenacker, R. T. s.n. May 1842 (BP, G, P [27]).
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- Holmgren, N. H., Fay, J. J. & Bethers, B. L. 4260 (W [9]).
- Hong, D. Y. PB88007 (PE [2]), PB86071, PB86073, PB86074, PB90010 and PB90011 (PE [15a]).
- Hong, D. Y. et al. 0190 (PE [26]).
- Hong, D. Y. et al. Population 1 and 092 (PE [26]).
- Hong, D. Y. et al. Population No. 2, No. 4 (PE [26]).
- Hong, D. Y. et al. Population No. 3, No. 5 and 0128 (PE [14a]).
- Hong, D. Y. & Chen, T. PB86007 (PE [5]), PB86003 and PB86006 (PE [15a]).
- Hong, D. Y. & Feng, Y. X. H97069 (PE [5]), H97066 (PE [6]).
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- Hong, D. Y. & Qiu, J. Z. PB86052, PB86062 and PB86072 (PE [15a]).
- Hong, D. Y. & Quintanar, A. H03019 (MO, PE [18]), H03018 (A, CAS, K, MO, PE [24]).
- Hong, D. Y. & Rao, G. Y. H98033 (A, CAS, MO, PE, US [15a]).

- Hong, D. Y. & Ren, Y.* H04036 (PE [22]).
- Hong, D. Y. & Vargos, P.* H03015 (A, BM, CAS, K, MO, P, PE [18]), H03016 (MO, PE [32c]), H03017 (PE [18]).
- Hong, D. Y. & Wang, X. Q.* H01025 (A, BM, CAS, K, MO, P, PE [16]), H01019 (PE [21d]).
- Hong, D. Y. & Xiang, Q. Y.* H99076 (PE [9]).
- Hong, D. Y. & Xu, A. S.* H06013 and H06014 (PE [1]).
- Hong, D. Y. & Ye, Y. Z.* H94003 (PE [4a]) and H94004 (PE [15b]).
- Hong, D. Y. & Yu, H.* H04031 (PE [22]).
- Hong, D. Y. & Zhong, Z. H.* PB82105 (PE [14b]), PB82122 (PE [22]).
- Hong, D. Y. & Zhou, S. L.* H99029 (A, CAS, K, MO, PE, US [20b]), H99039 (MO, PE [20b]), H99059 (A, CAS, K, MO, PE, US [20b]), H99060 and H99065 (A, CAS, K, MO, PE, US [20c]), H99062 (MO, PE [20c]), H99035 (A, CAS, K, MO, PE, US [20d]), H99046 (A, CAS, K, MO, PE, US [20e]), H99025, H99068 and H99063 (PE [20g]), H99028, H99043, H99052 and H99053 (A, CAS, K, MO, PE, US [27]).
- Hong, D. Y. & Zhou, Z. Q.* H06008 and H06010 (PE [3a]), H04042 (PE [4a]), H04041 (PE [7]), H06006, H06007, H06009 and H06011 (PE [14b]), H04044 (PE [15b]).
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- Hong, D. Y., Chen, Y. & Song, S. Y.* PB85078 (PE [15a]).
- Hong, D. Y., Ding, K. Y. & Gao, L. Z.* H96172 (PE [15a]).
- Hong, D. Y., Luo, Y. B. & He, R. H.* H95034 and H95075 (A, K, MO, PE, US [14b]), H95074 (PE [2]), H95063 and H95070 (A, K, MO, PE, US [2]), H95035, H95036, H95037, H95050 and H95080 (A, K, MO, PE, US [3a]), H95030 (PE [3b]), H95031 (A, K, MO, PE, US [2]), H95035, H95036, (K, PE [3b]), H95015, H95017 and H95032 (A, K, MO, PE, US [3b]).
- Hong, D. Y., Luo, Y. B. & Zhang, S. R.* H96005, H96007, H96014, H96020 and H96030 (A, K, MO, PE, US [1]), H96003, H96004, H96019 H96024, H96028 and H97119 (A, K, MO, PE, US [2]), H96029 (A, K, MO, PE, US [13]).
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- Hong, D. Y., Pan, K. Y. & Lou, L. H.* H98002 (PE [15a]) and H98001 (A, CAS, K, MO, PE, US [15a]).
- Hong, D. Y., Pan, K. Y. & Qiu, J. Z.* H05011 (A, BM, CAS, K, MO, P, PE [10]), H05012 (A, BM, CAS, K, MO, PE [10]).
- Hong, D. Y., Pan, K. Y. & Rao, G. Y.* H98009 and H98013 (A, CAS, K, MO, PE, US [15b]), H98010 (A, K, MO, PE, US [15b]).
- Hong, D. Y., Pan, K. Y. & Ren, Y.* H06003 (A, BM, K, MO, PE [4b]).
- Hong, D. Y., Pan, K. Y. & Woodward, P.* H05020 (PE [9]), H05016 (A, CAS, BM, K, MO, PE [9]), H05019 (A, BM, K, MO, PE [9]), H05023 (BM, K, MO, PE [9]).
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- Hong, D. Y., Pan, K. Y. & Zhang, S. Z.* 94007 (PE [5]).
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- Hong, D. Y., Pan, K. Y., Wang, S. Y. & Rao, G. Y.* H98005 (PE [5]).
- Hong, D. Y., Pan, K. Y., Yu, H. & Dai, B.* H97077, H97078, H97087, H97095, H97102, H97103, H97108, H97110, H97111, H97112, H97119 and H97128 (A, CAS, K, MO, PE, US [2]).
- Hong, D. Y., Vasic, O. & Stojšić, V.* H03020 (PE [32b]).
- Hong, D. Y., Wang, X. Q. & Fridlender, A.* H01013 (MO, PE [17]), H01014, H01015 and H01018 (A, BM, CAS, K, MO, PE, UPA [17]), H01016 (A, CAS, K, MO, PE [17]), H01030 (PE [21a]), H01023 (A, CAS, K, MO, PE, UPA [21a]), H01020 (A, CAS, BM, K, MO, PE, UPA [21d]), H01009 and H01012 (A, BM, CAS, K, MO, PE [32c]).
- Hong, D. Y., Wang, X. Q. & Yuan, Y. M.* H01029 (A, BM, CAS, K, MO, P, PE [32a]).
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- Hong, D. Y., Ye, Y. Z. & Feng, Y. X.* H97024 (PE [4a]), H97015 (PE, MO [4a]), H97016 and H97051 (A, CAS, K, MO, PE, US [4a]), H97058 (A, CAS, K, MO, PE, US [4b]), H97021 and H97052 (PE [5]), H97045 (PE [7]), H97027 and H97028 (MO, PE [7]), H97023 and H97029 (A, K, MO, PE, US [7]), H97002, H97030, H97046, H97050, H97056 and H97057 (PE [15b]), H97003 (MO, PE [15b]), H97053 (A, CAS, K, MO, PE, US [22]).

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- Hong, D. Y., Zhang, D. M., Wang, X. Q. & Koruklu, S. T. H02213 (MO, PE [20a]), H02215 and H02221 (A, CAS, K, MO, PE, UPA [20a]), H02211 (MO, PE [21a]), H02212 (PE [21a]), H02203 (A, CAS, K, MO, PE, UPA [21b]), H02208 and H02210 (A, BM, CAS, K, MO, PE, UPA [23]), H02214 and H02207 (A, BM, CAS, K, MO, PE, UPA [23]), H02201 and H02223 (A, BM, CAS, K, MO, PE [28]), H02204 and H02216 (A, CAS, K, MO, PE, UPA [30]), H02217 (A, K, MO, PE [30]), H02218 (PE, UPA [30]), H02220 (PE [30]).
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- Hood, M. V. s.n. 25 Mar. 1945 (A [10]).
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- Hoover, R. F. 5762 (CAS [9]).
- Hörandl, E. & Hadaček, F. 8608 (W [19a]).
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- Hotta, M. et al. 22, 27 and 83 (KYO [15a]).
- Hotta, M. & Wakabayashi, M. 171 (KYO [15a]).
- Hou, X. Y. 11759 (PE [15a]).
- Howell, J. T. 12146 and 13238 (CAS [9]), 50 and 809 (A [10]), 2450 (CAS [10]).
- Howell, T. J. s.n. July 1880 (US [9]).
- Hsia, W. Y. 3519 (PE [6]), 1111 (PE [11]), 4539, 4571 and 5707 (PE [14b]), 4598 (PE [15b]), 36 (PE [22]).
- Hu, W. G. 13050 (PE [14b]), 37902 (PE, SZ [15a]).
- Hu, X. G. 522 (PE [11]).
- Hu & He 10088, 10373, 10463 and 11173 (PE [14b]).
- Huadong Station 6051 (PE [15a]).
- Huang 489 (PE [15a]).
- Huang, Luo & Jiang 730 (PE [14b]).
- Huanghe Exped. 1015, 4453 and 4625 (PE [11]), 1689, 03183, 4655 and 4735 (PE [14b]), 202 and 762 (PE [15b]).
- Huanghe Exped. Gansu First Team 02168 (PE [14b]).
- Hubler, T. s.n. June 1884 (K [17]).
- Huet du Pavillon, E. & A. 449 (G [21d]), s.n. 23 May 1855 (BM, G, P [21d]), s.n. 2 Apr. 1855 (BM, G, K [21d]).
- Huldunson, W. 3550 (A [9]).
- Humphris, C. J. & A. R. 60 (BM [24]).
- Hupingshan Exped. 1317 (PE [15a]).
- Hurtado, J. s.n. 2 June 1973 (MA [24]).
- Husak, S. s.n. 27 Apr. 1979 (GZU [20a]).
- I.S.G. s.n. May 1893 (G [12]).
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- Igarashi, F. 23(?) (KYO [15a]).
- Igolkin, G. 97 (LE [26]).
- Igoshina, K. s.n. 26 June 1971 and s.n. RUSSIA, Verhne-Chusovskaya Distr.: Popovo (LE [14a]).
- Ikonnikov & Fridman 892 (LE [26]).
- Ikonnikov-Galitzky, N. 424 (LE [14a]).
- Iljin, D. s.n. 4 June 1904 and s.n. 31 May 1904 (LE [14a]).
- Iljin, V. s.n. 28 May 1909 (LE [14a]).
- Imréné, S. s.n. 26 May 1956 (BP [32b]).
- Inner Mongolia Univ. 73, 93, 53 and 96 (HIMC [11]), 60, 263 and 62-2-74 (HIMC [15a]).
- Inst. Biol. & Ped. 66 (XJBI [26]).
- Inst. Drug Control. Jing 0059 (PE [15b]).
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- Integrated Inst. Hydr., Ped. & Biol. Resources 5788 (XJBI [26]).
- Ipse s.n. 25 Apr. 1876 (BP, G [27]), s.n. 30 June 1937 (WU [32a]).
- Irinskai & Kirpichnikov s.n. 4 May 1946 (LE [20e]).
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- Isachenko, T. I., Pivnik, S. A. & Samarina, G. D. 65 (LE [11]).
- Ispolatov, E. s.n. 14 Aug. 1929 (LE [14a]).
- Ito, M. 783 (KYO [15a]).
- Ivanova, M. 148 and s.n. 20 June 1927 (LE [11]).
- Jackson, B. R. s.n. June 1932 (A [9]).
- Jacquemoud, F. & Jeanmonod Mar, D. 1165 (G [24]).
- Jacquemont, V. 668 and 750 (P [12]).
- Jaeger E. C. s.n. 1924 (A [10]).
- Jahandiez, E. 336 (BM, G, P [24]).
- Janka, V. de s.n. June 1854 (G [27]), s.n. 14 May 1868 (B, BM [27]), s.n. 14 May 1868 (B, BM, G, WU [27]), s.n. 15 May 1869 (B, G, WU [27]), s.n. 29 Apr. 1876 (BP, G [27]), s.n. 23 Apr. 1876 (WU [27]), s.n. 18 May 1878 (BM [27]), s.n. 14 May 1878 (BP, E, G, WU [27]).
- Javic, D. s.n. 15 June 1995 (NSAD [32b]).
- Javorka, S. s.n. 26 Apr. 1930 (BP [32b]).
- Javorka, S. & Timko, G. 739 (BM, BP, E, F, G, GZU, K, LD, M, US, W [32b]), s.n. 8 Apr. 1914 and s.n. 21 Apr. 1917 (BP [32b]).

- Jelenetzky* s.n. July 1885 (G [20a]).
- Jenora* s.n. ITALY, Rasarno (RO [21a]).
- Jia*, H. Y. 023 and 024 (PE [4a]), 001, 002, 004, 005, 011, 034, 036, 038, 042 and 043 (PE [5]).
- Jia*, S. X. 229 (PE [14b]).
- Jiang*, S. 5708 (PE [2]), 5768, 8874, 8930, 8965, 9082, A-7162 and A-7275 (PE [14b]).
- Jiang*, S. & *Jin*, C. L. 00423 (PE [4a]), 00386 and 2113 (PE [14b]), 1526 (PE [15b]).
- Jiang* & *Xiong* 34242, 34319 and 35625 (PE [14b]).
- Jiang*, X. C. (*H. L. Tsiang*) 36014 and 36433 (PE [14b]), 33937 (PE [22]).
- Jim* & *Jenny Archibald* 5119 (ATH [21a]).
- Jin*, D. F. 038 (PE [15a]).
- Jing* 0059 (PE [11]).
- Joad*, G. C. 1882 (K [32a]).
- John*, H. St. & *Smith*, C. P. 8268 (F [9]).
- Johnson*, M. S. 72 (IDS [9]).
- Jones*, M. E. 6134 (MO [9]), s.n. 5 Apr. 1933 and s.n. 5 Apr. 1934 (A [10]).
- Jorge*, A. R. s.n. May 1903 (COI [18]).
- Jovanovic et al.* s.n. 3 July 1998 and s.n. 4 July 1998 (BGUB [32b]).
- Jurasky* s.n. 5 Apr. 1985 (WU [19b]).
- Jyson*, S. s.n. 2 Apr. 1943 (A [10]).
- Kaemer* s.n. 9 June 1887 (B [32a]).
- Kaim*, H. s.n. 17 Apr. 1951 (COI [18]).
- Kalinina*, A. V. s.n. 2 Aug. 1949 (LE [14a]).
- Kang*, Y. M. s.n. 8 Sep. 1969 (SNU [15a]).
- Kapeller*, O. s.n. 13 May 1939 (TBI [20d]).
- Karamysheva*, Z. V. & *Safronova*, I. N. 1270 (LE [11]).
- Karamysheva*, Z. V., *Sanchir*, G. & *Sumerina*, I. Y. 207 (LE [14a]).
- Karev*, G. 61 (LE [11]).
- Karpati*, Z. s.n. 5 May 1934 and s.n. 12 May 1935 (BP [32b]).
- Karpenko*, A. S. & *Davydova*, L. M. 44, 63 (LE [15a]).
- Karo*, F. 3, 67 and s.n. June 1903 (LE [11]), 142 (K [11]).
- Kato*, M. s.n. JAPAN, Hiroshima: Saiki-gun, Mizudamura (KYO [15a]).
- Kayacik* & *Yaltirik* 3269 (E [28]).
- Kazakevich*, V. 601, 672 and 683 (LE [11]).
- Kazansky* 8 (LE [11]).
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- Keller*, B. s.n. 1 Aug. 1908, s.n. 6 Aug. 1908 and s.n. Aug. 1908 (LE [14a]).
- Kemularia-Nathadze* s.n. 30 May 1928, s.n. 12 Apr. 1932 and s.n. 23 Mar. 1966 (TBI [20b]), s.n. 25 July 1960 (TBI [20c]), s.n. 5 May 1939, s.n. 12 May 1939, s.n. 6 May 1958 and s.n. 11 May 1976 (TBI [20d]), s.n. 20 July 1929 and s.n. 20 July 1945 (TBI [20g]).
- Kemularia-Nathadze et al.* s.n. 15 June 1958 (TBI [20g]).
- Kennedy*, E. W. 1624 (K [21a]).
- Kennedy*, P. B. s.n. 20–25 June 1907 (CAS [9]), 901 (US [16]).
- Kerner*, A. s.n. ITALY, Mt Baldo (G [32a]), s.n. 1864 and s.n. ITALY, Mt Baldo, Magla (WU [32a]).
- Kessab* s.n. Mar. 1881 (G [21a]).
- Ketskovieli et al.* s.n. 12 May 1964 (TBI [20b]).
- Ketskovieli* s.n. Apr. 1959 and s.n. 6 May 1959 (TBI [20b]), 15 May 1958 and s.n. 5 May 1964 (TBI [26]), s.n. 15 May 1958 (E [27]), s.n. 15 May 1958 (LE [27]).
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- Khanminchun*, V. & *Andreev*, A. 514 (LE [14a]).
- Kharadze*, A. s.n. 23 Mar. 1966 and s.n. 27 Mar. 1966 (TBI [20b]).
- Kihlman*, A. O. 254 (WU [14a]).
- Kikodze* s.n. 3 July 1914 and s.n. 6 July 1914 (LE [20c]).
- Kildushewsky*, I. 150/22 (LE [14a]).
- Kiling*, M. 3326 and 4067 (ANK [28]).
- Kingdon-Ward* 238, 3981, 4043, 5055 and 5691 (E [2]).
- Kisnetsow*, I. W. 99, 121, 141 and 682 (LE [15a]).
- Kitagawa*, M. & *Fu*, P. Y. 189 (PE [11]).
- Kitov*, M. s.n. 25 July 1955 (LE [20a]).
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- Klementz*, K. 652 (BP, G, WU [27]).
- Klopotov*, B. 113, 180, s.n. 30 May 1909 and s.n. 27 June 1909 (LE [14a]).
- Knorrung*, O. 25, 60 (LE [26]).
- Koellenstein*, K. V. s.n. ITALY, Verona: Hügel (BM, GZU [32a]).
- Koelz*, W. 16510 (US [20e]).
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- Kol* s.n. 1902 (SOM [28]).
- Kolasochek* s.n. 17 May 1897 (GZU [32a]).
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- Kolesnikov*, N. 93 (LE [15a]).
- Kolodkina*, s.n. 24 May 1974 (LE [15a]).
- Kolomoitseva*, S. 236 (LE [14a]).
- Komarov* s.n. 17 May 1940 (LE [20g]).
- Komarov*, V. L. 211, s.n. 13 June 1896 and s.n. 26 May 1896 (LE [11]), s.n. 5 June 1962 (LE [14a]), 1553, s.n. 15 June 1895, s.n. 1 June 1897, s.n. 18 June 1897 and s.n. 20 May 1897 (LE [15a]).
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- Konta*, F. & *Murata*, K. 1171 (KYO [15a]).
- Kopteeb* 214 (WU [14a]).
- Korneev* 13 (LE [15a]).
- Koroleva*, A. & *Nikitin*, V. 138 (LE [26]).
- Korotky*, M. 701 and 706 (LE [11]).
- Korovkin*, A. 290 (LE [14a]).
- Korshinsky*, S. s.n. 11 June 1891, s.n. 28 May 1891, s.n. 4–12 June 1891 and s.n. 18 June 1891 (LE [11]),

- s.n. 2 Aug. 1887 (LE [14a]), s.n. 8 June 1891 (LE [15a]).
- Korzhevin, V. s.n. 10 Aug. 1926 (LE [15a]).
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- Kosovanova, M. s.n. 12 June 1912 (LE [11]).
- Kotov & Omelchuk s.n. 25 May 1958 (LE [20b]).
- Kotov, M. & Karnauch, E. s.n. 19 May 1948 (PE [27]).
- Kotschy, T. s.n. 11 May 1862 (K [21a]).
- Koyama, H. et al. 46 (KYO [15a]).
- Koyama, H. & Murata, G. 4272 (KYO [15a]).
- Kozlowsky, W. s.n. 11 May 1918 (TBI [20b]), s.n. 24 May 1920 (TBI [20c]).
- Krasan, K. s.n. ITALY, Trieste: Prosecco (GZU [32a]).
- Krashennikov, I. M. 247 and 1075 (LE [11]).
- Krasnoborov, I. & Bezyazykova, N. 165 (LE [14a]).
- Krasnoborov, I. M. & Krasnoborov, I. 1233 (LE [14a]).
- Krasnoborov, I. M. & Sannikova s.n. 15 June 1965 (LE [14a]).
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- Krendl, F. s.n. 16 Apr. 1971 (W [16]).
- Kresadlo, F. s.n. 3 May 1935 (BP [32b]).
- Krestovskaya, T. 235 (LE [15a]).
- Kretschmer, G. 325 (W [32e]).
- Krishtofovich, A. 132, 133, 134, 135 and 136 (LE [11]), s.n. 19 June 1910 (LE [14a]).
- Krylov, N. P. 28 (LE [11]), s.n. 22 June 1876, s.n. 22 June 1886 and s.n. 3 June 1892 (LE [14a]), 410, N I, N II-11, N III-42, N 8a-III and s.n. 29 June 1919 (LE [15a]).
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- Kryukov, I. F. 1119 (LE [15a]).
- Kryukov, I. T. 1107 (LE [11]), 1381 (LE [15a]).
- Kuan & Chen 711 (PE [11]).
- Kuan, K. C. 77309 (PE [14b]), 5843 (PE [15a]), 2611 (PE, XJBI [26]).
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- Kuan, K. C. & Dai, T. L. 2418, 2582 (PE [15b]).
- Kuan, K.C., Wang, W.T. et al. 272 (PE [11]).
- Kuan, Wang et al. 243, 352 and 732 (PE [14b]).
- Kucherovskaya, S. 282 (LE [14a]).
- Kumetroff s.n. 30 Aug. 1855 (LE [15a]).
- Kuminova & Alexeeva s.n. 2 June 1964 (LE [14a]).
- Kümmerle, J. B. 313, s.n. 13 June 1906 (G [20f]), s.n. 13 June 1907 (BP [20f]).
- Kung, H. W. 59 and 1769 (PE [11]), 336 (PE [15a]).
- Kunming Inst. Bot. 9463 (KUN, PE [2]).
- Kuo, P. C. 1493 (PE [15b]).
- Kurosaki, N. 6771, 7417, 10731 and 15145 (KYO [15a]).
- Kusnetzova, G. s.n. 5 May 1955 (PE [27]).
- Kusnetzowa, E. S. s.n. 15 June 1909 (LE [15a]).
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- Kuvajev & Sabitov, s.n. 1 June 1962 (LE [14a]).
- Kuzeneva, O. 62 (LE [11]).
- Kuzeneva, O. I. 222 and 485 (LE [15a]).
- Kuzhazheladze s.n. 4 May 1948 (TBI [20b]).
- Kuzmina, L. & Trukhaleva, N. s.n. 9 July 1968 (LE [20e]).
- Kuznetsov (Kuznetsov), I. 44, 101 and 129 (LE [11]), 53, 114, 193 and 4661 (LE [14a]).
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- Kuznetsov, E. 17338 (LE [14a]).
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- Kychakov, I. P. s.n. 9 June 1912 (LE [11]).
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- Ladygin 92 (LE [14a]).
- Ladygin, V. s.n. May 1896 (LE [26]).
- Ladygina, Ikonnikov & Fridman 1337 (LE [26]).
- Lam, L. W. s.n. June 1901 (BM [24]).
- Lambinon, J. 94/MA/486 (MA [24]).
- Lamond, J. 1828 (E, G, W [12]).
- Lan, S. B. 392 (PE [2]), 378 (PE [22]).
- Landrum, L. R. 7820 (F [10]).
- Lanza, D. s.n. Apr. 1890, s.n. 7 June 1890, s.n. June 1890 and s.n. June 1890 (RO [21d]).
- Lashinsky & Ronginskaya 973 (LE [14a]).
- Laszlo, H. s.n. 7 July 1897 (BP [30]).
- Lathrop, E. W. 4361, 5636 and 6077 (A [10]).
- Lavkina, A. B1393 (LE [15a]).
- Lawrance, W. M. E. 664 (CAS [9]).
- Le Fleming s.n. July 1969 (K [14a]).
- Le, T. Y. s.n. CHINA, Shaanxi-Gansu Basin (PE [6]).
- Lebedeva s.n. 20 May 1981 (LE [20b]), s.n. 29 Apr. 1989 (LE [20g]).
- Lebedeva & Faleeva s.n. 5 June 1955 (LE [26]).
- Ledebour s.n. 1834 (LE [11]), s.n. RUSSIA, Caucasus (LE [27]).
- Lee, J. H. s.n. 13 May 1988 (SNU [15a]).
- Leep, H. J. 71-11 (SA [19a]), s.n. 21 Apr. 1972 (SA [19b]), s.n. 19 May 1972 (SA [20a]), 74-6 (SA [21a]), 76-T44 (SA [23]), 72-7, 76-T50 and 77-T9 (SA [28]), 70-72, 7241, 72-46, 72-57, s.n. 12 May 1970, s.n. 18 May 1972 and s.n. 30 May 1972 (SA [30]), s.n. 11 Aug. 1973 (SA [32a]).
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- Lehel, B. s.n. 3 May 1951 (BP [32b]).

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- Leiniger*, G. s.n. 16 May 1937 (IDS [9]).
- Lengyel*, G. s.n. 20 June 1905 and s.n. May 1912 (BP [32b]).
- Leonis*, C. 45 (G, K, WU [19a]).
- Leonova* 459 (LE [27]).
- Lereocke* s.n. June 1844 (G [21d]).
- Leresche*, L. s.n. 18 July 1877 (G [32c]).
- Leskov* 203 (LE [20b]).
- Levier*, E. s.n. 17 Aug. 1878 (G, GZU [18]), s.n. 14 May 1870 and s.n. Apr. 1877 (WU [21a]), s.n. Apr. 1879 (G [21a]), s.n. Apr. 1886 (BM, GZU [21a]), s.n. 1 Aug. 1873 (BM [32d]), s.n. ITALY, Abruzzi: Mt Maiella (GZU [32d]).
- Levkov*, A. & Maskil, I. 218 (LE [14a]).
- Levne*, B. s.n. 17 Apr. 1949 (BP [32b]).
- Lewalle*, J. 9883 (BM [24]).
- Li & Xu* 64-9, 64-26, 64-38, 64-43, 64-47, 64-48 and 64-64 (CPB [2]).
- Li, A. R. & Zhu, J. N.* 10414 (PE, XJBI [26]).
- Li, J. D. & Xu, Z. M.* 64-100 (CPB, PE [3b]).
- Li, J. Y.* 823, 1190 and 6367 (IFP [15a]).
- Li, K. F.* 61119 (PE, SZ [15a]).
- Li, P. X.* 10100, 10137 and 10143 (PE [14b]).
- Li, Q. H. & Chen, C.* 888 (PE [15a]).
- Li, Q. S., Fu, P. Y. et al.* 2524 (IFP, PE [15a]).
- Li, S. X.* 160 and 206 (PE [11]), 151, 651, 4437 and 4710 (IFP [15a]).
- Li, X.* 77098 (PE, SZ [3a]), 70247, 70441, 70510, 70685, 70719, 70867, 70903, 71029, 71087, 71196, 71645, 74842 and 74936 (PE [14b]).
- Li, X. & Zhou, J. X.* 73835 (PE, SZ [15b]).
- Li, X. Y.* 870147 (SHI [14a]), 870169 (SHI [26]).
- Li, Xu & Tang* 64-11, 64-17, 64-19, 64-20 and 64-26 (CPB [2]).
- Lian & Chen* 31 and 72 (NWTC [14b]).
- Lian, Wang et al.* 79197 (NWTC [14b]).
- Liang*, C. Z. 108, 966, 1054, 92-223 and 92-296 (HIMC [11]).
- Liang, Fan, Li et al.* 378 (HNWP [14b]).
- Licent*, P. 1909 (PE [6]), 7586 (PE [11]), 2022 (PE [14b]), 2622 (PE [15a]).
- Lieors*, V. s.n. 12 May 1869 (WU [32a]).
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- Lin*, C. Q. 993, 1232, 1377 and 1455 (IFP [15a]).
- Lin, S. Q. et al.* 34 (XJBI [26]).
- Lin, Y. Y.* 7 (IFP [15a]).
- Lindauer*, G. s.n. Apr. 1888 (BM, BP, G, K [32b]).
- Lindberg*, H. 1220 (K [18]), s.n. 18 June 1939 (LD [21a]).
- Ling*, C. F. 4105 (SM [4a]).
- Ling*, Q. 7708 (KUN [2]).
- Ling*, Y. R. 74243, 74848 and 74849 (PE [26]).
- Linsdale*, J. M. & M. A. 466 (CAS [9]).
- Liou*, K. M. 1988 (PE [11]), 5659, 5970, 6019, 6044 and 6178 (PE [14b]), 217, 394, 2004 and s.n. CHINA, Hebei, Zhuhua: Eastern Tombs (PE [15a]).
- Liou*, T. N. 01 6149 (PE [2]), 20677 (KUN, PE [2]), 1077, 1411, 3906, 4740 and 6883 (IFP, PE [15a]), 10887 (PE [15b]).
- Liou*, T. N. et al. 437 (IFP [15a]).
- Liou*, T. N. & Tsoong, P. C. 491 and 2486 (PE [11]).
- Liou*, T. N., Tsoong, P. C. & Tien, C. S. 127 (PE [4b]).
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- Lippert* 144 (B [32a]).
- Lippert*, W. & Merxmüller, H. 20177 (M [32c]).
- Lipsky* s.n. 28 May 1892 (LE [27]).
- Lipsky*, V. 1697 (LE [26]).
- Liu & Luo* 1040 (HNWP [14b]).
- Liu & Shen* 8308 (XJBI [14a]).
- Liu*, D. C. 0447 (CPB [2]), s.n. 3 May 1964 (KUN [22]).
- Liu*, J. M. 10226 (PE [22]).
- Liu*, J. N. s.n. 3 Aug. 1967 (PE [14a]).
- Liu*, L. H. 9344 (PE [15a]).
- Liu*, S. W. 2115 (HNWP [14b]).
- Liu*, T. W. 427 (PE [11]).
- Liu*, T. W. & Zeng, Z. F. 165 (PE [6]).
- Liu*, X. Y. 1158 (PE [11]), 433, 483 and 1665 (PE [15a]), 21363 (PE [15b]).
- Liu*, Y. 12409 and 12661 (PE [11]), 10266 and 11344 (PE [15a]), 570 (PE [15b]).
- Liu*, Y. X. et al. 1427 (IFP [15a]).
- Liu*, Z. Y. et al. PB86027 (PE [15a]).
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- Lofthouse*, T. A. s.n. 7 June 1926 (BM [18]).
- Lombark*, C. s.n. FRANCE, Alpes-Maritimes, Gard: le Vigan, Ventousc (K [32c]).
- Lomonosova & Ivanova* 89 (LE [14a]).
- Long*, X. F. 85 (NWTC [14b]).
- López*, G. 882 GF (MA [24]).
- López*, G. & Valdes-Bermejo, E. 1636 GF (MA [24]), s.n. 23 June 1974 (MA [32c]).
- Lu*, Y. C. 3372 (IFP [15a]).
- Lu*, Z. W. 1002 (KUN [2]).
- Ludewig*, L. 804 (LE [11]).
- Ludlow & Sherriff* 1376 (E [2]).
- Luo*, Y. B. 9723 (PE [2]).
- Lynes*, H. 152 (BM [24]).
- Lynggrassesides*, A. 1570 (K [21a]).

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- Lytsky s.n. 22 May 1889 (LE [20b]).
- Ma, C. G. *et al.* 68 (PE [15b]).
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- Maak, R. s.n. RUSSIA, Primorsky Prov.: Sungatsci (LE [15a]).
- Mabile, P. 102 (P [17]).
- Macbride, J. F. 536 and 943 (CAS, F, MO [9]).
- Macbride, J. F. & Payson, E. B. 2886 (MO [9]).
- Maguire, B. 16818 (CAS, IDS [9]).
- Maguire, B. & Holmgren, A. H. 22462 (MO [9]).
- Magulaev s.n. 21 May 1974 (LE [27]).
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- Maire, E. E. s.n. May 1912 (E [22]).
- Maire, R. s.n. 8 May 1927 (G [24]), s.n. 19 Apr. 1926 and s.n. 21 Apr. 1933 (P [24]), s.n. 26 Oct. 1918 and s.n. 31 May 1914 (MPU [25]).
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- Makov s.n. 22 July 1977 (LE [11]).
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- Malicky, M. s.n. 13 June 1974 (G, W [21a]).
- Malinova, A. 40 and 41 (LE [15a]).
- Maltsev, N. 79 (LE [14a]).
- Maly, K. s.n. 30 May 1911 (K [20a]), s.n. 3 June 1911 (WU [30]), s.n. 21 May 1911 (K [32b]).
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- Mamorina-Kiseleva, O. s.n. 13 Sep. 1927 (LE [15a]), s.n. 22 Aug. 1927 (LE [11]).
- Mamotina s.n. 10 June 1925 (LE [15a]).
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- Mansanet, Borja & Cardona s.n. 22 July 1949 (MA [32e]).
- Mansvttod 96 (LE [11]).
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- Mao, Z. M. 10413 (XJBI [14a]).
- Maquire, B. & Holmgren, A. H. 26523 (US [9]).
- Marcus, E. & Jones, A. M. s.n. July 1881 and s.n. 28 June 1897 (A [9]).
- Maren s.n. 7 June 1933 (BC [16]).
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- Marini, E. s.n. 28 June 1886 (RO [32d]).
- Marsilly, C. de s.n. 20 Apr. 1866 (BM, G, K [17]).
- Martelli s.n. May 1887 (B, GZU, WU [21a]).
- Martindale, G. E. 146 (K [16]).
- Mata, D. S. s.n. 17 July 1981 (GZU [18]).
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- Mathannet, L. s.n. 20 Apr. 1860 (B [21a]), s.n. May 1861 and s.n. 07.1861 (BM [21a]), s.n. 4 July 1861 and s.n. 1869 (G [21a]), s.n. 17 May 1861 (K [21a]).
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- Matveev, V. s.n. 11 July 1945 (LE [14a]).
- Matvejev, S. s.n. 28 May 1949 (BEO [20a]).
- Mauritz, T. 77 and s.n. 6 July 1899 (LE [11]).
- Maximova 133 and s.n. 6 May 1969 (LE [20b]).
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- Maximowicz, C. J. s.n. 1 Sep. 1860 and s.n. 13 Sep. 1860 (LE [15a]).
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- McLaren 5, 55, 89 and V2 (E [2]).
- McMillan, E. s.n. 4 Apr. 1972 (CAS [10]).
- McMurphy, J. 638 (A, CAS [9]).
- McNeil 621 (E, K [21a]).
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- Meebold, A. s.n. June 1926 (K [32a]).
- Meffert 956 and 957 (LE [20c]), s.n. 4 Nov. 1925 and s.n. Nov. 1927 (LE [20g]).
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- Menitsky, Y. & Popova, T. 14 and s.n. 28 July 1975 (LE [20e]).
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- Menke, M. 89 (CAS [10]).
- Mercier s.n. June 1893 (G [32a]).
- Merkatis 10980 (ATH, BM [17]).
- Merxmüller, H. & Gleisner, W. 26638 (M [32e]).
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- Mikheev* s.n. May 1984 (LE [20b]).
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- Miki*, E. 213 (KYO [15a]).
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- Mills*, R.G. s.n. KOREA, Chongyang (PE [15a]).
- Mimoro*, K. et al. 3901 (KYO [15a]).
- Minagi*, S. s.n. JAPAN, Hokkaido: Tomakomai (KYO [15a]).
- Mish*, C. A. 6 (MO [10]).
- Mitsuta*, S. 12681 (KYO [15a]).
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- Mizul* s.n. 4 Sep. 1871 (LE [15a]).
- Moehrlm*, A. s.n. 27 Apr. 1905 (G [27]).
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- Moller*, A. s.n. June 1884 (COI [18]).
- Molleson*, M. I. s.n. 21 June 1903 (LE [14a]).
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- Montell*, J. s.n. 22 July 1899 (G, K, P, WU).
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- Mordak* & *Dorofeev* 2183/102 and 2273/191 (LE [20b]).
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- Mordak* 486 (LE [20b]), 251 (LE [20e]), s.n. 2 July 1964 (LE [20g]).
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- Morgan*, P. 23 (K [14a]).
- Mori*, A. s.n. ITALY, Modena Prov. (K [30]).
- Mori*, D V. s.n. 24 June 1933 (B [32a]).
- Morida*, H. s.n. JAPAN, Hokkaido: Sapporo (KYO [15a]).
- Moris* s.n. 1830 and s.n. 1839 (G [17]).
- Morrison*, J.W. s.n. California, Lassen Co: Loyaltan, Sierra Valley (A [9]).
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- Moualt*, T. s.n. E coast, Mt Nupuripo (SAPS [15a]).
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- Moxley*, G. L. 209 (A [10]).
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- Munoz Medina* s.n. 15 May 1950 (BC [18]).
- Muñoz*, F. & *Valdes-Bermejo*, E. 5600 EV (MA [32e]).
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- Muñoz-Garmendia*, F. & *Navarro*, C. s.n. 8 June 1991 (MA [21a]).
- Munz*, P. A. 11816 (A [9]), 5112 (A [10]).
- Murata*, G. 7080, 7905, 9598, 10759, 11167, 17333, 18036 and 55612 (KYO [15a]).
- Murata*, G. et al. 125 (KYO [15a]).
- Murata*, G. & *Fukuoka*, N. 12 and 194 (KYO [15a]).
- Murata*, G. & *Iwatsuki*, K. 7 (KYO [15a]).
- Murata*, G. & *Shimizu*, T. 100, 817, 829, 2326, 2380, 2553 and 2576 (KYO [15a]).
- Murie*, J. C. 202 (US [9]).
- Murot*, J. s.n. 5 June 1857 (G [32a]).
- Murray*, R. P. s.n. 20 May 1908 (BM, GZU [18]).
- Nagai*, K. 24797 and s.n. JAPAN, Shiga: Sakata-gun, Maibara-cho, Kuregahata (KYO [15a]).
- Naithani*, B. D. 47920 and 48250 (CAL, G [12]).
- Naito*, Lang, *Tateishi*, *Nemoto* & *Li* 763 (PE [13]).
- Naito*, T. s.n. JAPAN, Miyagi: Oshika-gun, Kinkasan-to (KYO [15a]).
- Nakai*, G. 676 and 2257 (KYO [15a]).
- Nakai*, T. s.n. 9 June 1909 (TI [11]).
- Nanping Exped.* 0032 (SM [4a]).
- Nanshui Beidiao Exped.* 9194 (KUN, PE [2]), 02912 (PE [14b]).
- Naruhashi* 3063 (KYO [15a]).
- Naruhashi*, N. 2565 (KYO [15a]).
- Naumenko*, N. 313 (LE [14a]).
- Nei Monggol Univ.* (Q. R. Wu), s.n. CHINA, Mt Huanggangliang (HIMC [11]).
- Nei Mongol Exped.* 111 (PE [11]).
- Neiburg*, M. s.n. 9 June 1924 (LE [14a]).
- Neimar*, O. 198 (LE [11]).
- Nekrasova*, L. 481, 1047 and s.n. 22 June 1928 (LE [11]), 492 (LE [15a]).
- Nelson*, T. & *Anderson*, D. 885 (A [9]).
- Ni*, Wang, *Cidou* & *Cidan* 1501 (PE, XZ [2]), 0133 (PE, XZ [13]).
- Nikitia et al.* s.n. 19 Apr. 1987 (LE [20b]).
- Nikolaevsky*, B. s.n. July 1909 (LE [14a]).
- Nikolic*, V. & *Diklic*, N. s.n. 26 Apr. 1967 (BEO [32b]).
- Nilsson*, N. H. 735 and 735b (BM [18]), s.n. 22 July 1883 (G [18]), 1600 (BM, LD, WU [24]).
- Nimi*, P. L. & *Poelt*, J. s.n. 22 May 1985 (GZU [17]).
- Ningxia Phamaceutic Inspection Inst.* Nan 124 (PE [4b]).
- Noda*, M. 441 (IFP [15a]).
- Noda*, M. et al. 196 (IFP, PE [15a]).
- Normura*, N. s.n. KOREA, Ganwondo: Changjin (KYO [15a]).
- Nordborg*, G. & *Dahlgren*, R. 487 and 738 (LD [16]).
- Normal Univ. Exped.* 826 (PE [15a]).

- Norris, F.H. s.n. 11 May 1945 (BM [21a]).
North-East Exped. 160 (PE [11]).
Northeast Normal Univ. 664 (PE [15a]).
Northwest Univ. 68 and C0025 (PE [14b]).
Novopokrovsky, I. s.n. 13 Aug. 1908 (LE [11]).
Nydegger, M. s.n. 9 Apr. 1974 (LD [17]).
Ocakverdi, H. 1289 (ANK [21a]).
Oehm, H. s.n. May 1937 (BEO [20a]).
Oettingen, H. von 104, 109, 110, 111, 112, 113, 1037, 1681 and 2312 (LE [15a]).
Ohwi, J. 250, 1043(a), 2709(b), s.n. KOREA, Ganwondo: near Hamhung and s.n. JAPAN, Shimane: Tsuwanomachi (KYO [15a]).
Okamoto, M. 2438 (KYO [15a]).
Okamoto, S. s.n. JAPAN, Hokkaido: Kitanu, Kitanufuji and s.n. JAPAN, Niigata: Naebazan (KYO [15a]).
Olmsted 19 (A [10]).
Oppolzer s.n. ROMANIA, Transilvania (WU [30]).
Orell Casanovas, J. s.n. 17 June 1962 (G [16]).
Orlova, N. s.n. RUSSIA: Kirovsk Prov.: Afanasjevo, near Ponoy River mouth (LE [14a]).
Orphanides, T. G. 449 (BM, G, K, WU [31]), s.n. 20 July 1854 (BM [31]).
Oswald, P. H. 128 (K [21a]).
Pabot, H. s.n. 13 Sep. 1952, s.n. 25 July 1955 and s.n. 14 July 1956 (G [21a]), s.n. 24 Apr. 1953 and s.n. 6 May 1954 (G [23]).
Paira, Y., Matos, Y. & Margues, A. 8463 (COI [32e]).
Paiva, J. 172 (COI [18]).
Pajaron, S. 1396 (MA [18]).
Pajarov, S. et al. 473 (MA [32e]).
Pajarov, S. & Pascual, R. 326 (MA [32e]).
Palchevsky (Palczewski) s.n. 1 June 1875 and s.n. 1 June 1885 (LE [11]).
Palchevsky (Palczewski), N. A. s.n. 11 Aug. 1906 (LE [11]), s.n. 30 May 1901 and 144 (LE [15a]).
Pan, K. Y. & He, Y. H. 96002 and 96003 (A, K, MO, PE, US [3b]), 96004 (PE [22]).
Paniutin 958a (LE [20g]).
Panjковић, B. s.n. 14 June 1997 (NSAD [20a]).
Pantu, Z. C. s.n. 13 May 1901 (G [28]).
Papp, J. s.n. 20 Apr. 1946 and s.n. 21 Apr. 1946 (BP [32b]).
Paquale, G. A. s.n. ITALY, Abruzzi: Mt Corno (BM [32d]).
Parish, S. B. 11713 (A, MO [10]), s.n. Apr. 1891 (F [10]).
Parish, S. B. & W. F. 37 (F [10]).
Parker, D. s.n. 18 May 1948 (A [9]).
Parratt, M. 121 (A [10]).
Pasgnale, C. s.n. 9 June 1892 (G [32a]).
Pasleniza, G. s.n. ITALY, Messina (RO [21d]).
Pastukhori s.n. 1910 (LE [27]).
Patrievskaya, G. F. s.n. 29 Sep. 1954 (LE [15a]).
Patrin, M. s.n. RUSSIA, Altai Region: alpine Altai (G [14a]).
Patzki, L. T. 16976 (B [32a]).
Paulson, K. & R. 36 (CAS [9]).
Paun, M., Cirtu, D. et al. s.n. 20 May 1963 (BM, BUCA, G, PE [28]).
Pavillon 630 (G [30]).
Pavillon, E. & A. H. du 091 (G, W [32d]).
Pavlov, N. 332, 398 (LE [14a]).
Pawek, J. L. 439 (CAS [9]).
Payson, E. B. & L. B. 2196 (CAS, MO [9]).
Pedicino, N. A. s.n. ITALY, Rasarno (RO [21a]), s.n. ITALY, Abruzzi: Orfenta (RO [32d]).
Pedicino, N. A. & Mori, E. s.n. 24 July 1879 (RO [32d]).
Pedrol, J. 2752 JP (MA [32e]).
Pedrol, J. & Pedrol, C. 2249 JP (MA [32e]).
Pei, Y. L. 9113 and 9114 (PE [3a]), 9110 and 9111 (PE [3b]), 9115, 9116, 9140 and 9150 (PE [4a]), 916001 and 916005 (PE [4b]), 9002, 9170, 9180 and 9201 (PE [6]), 911001 (PE [7]).
Pei, Y. L. & Hong, D. Y. 93003, 93006, 93008, 93009, 93011 and 93427 (PE [6]).
Peirson, F. W. 6168, 10312 and 10382 (A [9]).
Peirson, M. B. 5434 (A [10]).
Pellat, A. s.n. 21 June 1885 (BM, G [32c]), s.n. 18 May 1891 (GZU [32e]).
Pen'kovskaya, E. & Eremenko, L. 1122 (LE [14b]).
Peng, G. T. 21139 (PE [14b]).
Peng, P. S. 170 and H93 (PE [15a]).
Perez Chiscano, J. L. s.n. 18 June 1994 (MA [32e]).
Peréz Raya, F. s.n. 13 May 1979 (MA [24]).
Perkins, R. M. 97 (A [10]).
Perreymond, M. s.n. 1839 (G [32c]).
Pesman, H. & Güner, A. 3467 (ANK [20a]), 4670 (ANK [21a]).
Petamidis, J. 1437 (ATH, BM [19a]).
Petiaev s.n. 1 Aug. 1930 (LE [20g]).
Petrova, V. N39C (LE [14a]).
Petrovic, S. s.n. May 1884 (G [28]) and s.n. May 1886 (WU [28]).
Petrowsky s.n. 1909 (LE [11]).
Pettibone, N. & Hubby, F. W. s.n. 12 May 1895 (CAS [10]).
Pevalek, I. s.n. 12 July 1919 (WU [20f]).
Peyron, E. 544 (G [20a]), s.n. 11 May 1882 (G [21a]).
Pharmaceutic Exped. 2015 and 2028 (PE [22]).
Pichlev, A. s.n. SERBIA, Deliblat, Peščara (BEO [32b]).
Pitman, M. & Wickham Turx, A. 253 (K [20c]), 250 (K [30]).
Plakhtij, A. S. s.n. 1915 (LE [11]).
Planchon s.n. May 1855 (G [32c]).
Plaskett, R. A. s.n. Feb. 1898 (US [10]).
Platt, K. B. s.n. 27 May 1938 (IDS [9]).

- Pobedimova* 697 (LE [14a]).
- Pobedimova, E. & Kononova, G.* 179 and 713 (LE [15a]).
- Podlech, D.* 13237 (M [20f]), 39365 (G [25]), 22832 (G, SA [32c]).
- Poelt, J.* 3037 (GZU [27]), s.n. 15 June 1973 (GZU [30]).
- Poelt, J. & Scheuer, Ch.* s.n. 3 May 1986 (GZU [17]).
- Pohle* s.n. 1899 (LE [14a]).
- Pohle & Rozhdestvensky* s.n. 18 June 1913 (LE [14a]).
- Polatschek, A.* 67 (W [18]), s.n. 24 May 2000 (W [27]).
- Polevoi* 60 (LE [15a]).
- Polevoi, M.* 7 (LE [11]).
- Pollard, H. M.* s.n. 6 May 1955 (A [10]) and s.n. 26 Feb. 1956 (CAS [10]).
- Polozhii & Kandasova* s.n. 7–11 June 1962 (LE [14a]).
- Poltozotsky* s.n. May 1889 (WU [27]).
- Polunin, O.* 10032 (ATH [19a]).
- Polunin & Davis* 24556 and 24809 (E, K [30]).
- Pomel* s.n. 24 July 1874 (MPU [25]).
- Poniatovskaya* s.n. KIRGHIZIA, Dzhalalabad Prov.: Kara-Alma, Toguz (Bulak) (LE [26]).
- Pons Y. & Guerau-Mahón, A.* s.n. 1900 and s.n. 7 May 1900 (MA [16]).
- Popov, I. V.* 1 (LE [15a]) and 53 (LE [15a]).
- Popov, M. G.* s.n. 2 July 1948 and s.n. 05.1948 (LE [15a]).
- Popova, V.P.* s.n. 26 June 1927 (LE [11]).
- Poretzky, A.* 192 (LE [15a]).
- Porta, P.* s.n. 17 June 1872 and s.n. June 1873 (BM [32a]), s.n. 1884 (BM, GZU, K, WU [32a]), s.n. 06.1893 (GZU, WU [32a]), s.n. 28 May 1867 and s.n. 17 Apr. 1868 (WU [32a]).
- Porta & Rigo* s.n. May–June 1885 (G, K [16]), 19 (WU [18]), 343 (B, G, K, P, WU [18]), 20 (B, BP, K, WU [24]), 343 (WU [24]), 862 (BM, BP, WU [24]), 289 (BM, G, K, WU [32e]).
- Potanin, G. N.* s.n. 1877 (G [14a]).
- Price, M. P.* 293 (K [14a]).
- Prilipko* s.n. 12 July 1929 (BAK [20c]).
- Prinada, V. D.* 82 (LE [11]).
- Priszhnyuk (Prisyazhnyuk), N.* s.n. 23 June 1976 (LE [11]), s.n. 26 June 1976 (LE [15a]).
- Pritzel, E.* 193 (B [32a]).
- Probyn, F. M.* 1951 (K [21a]).
- Prodan, I.* s.n. 7 June 1924 and s.n. June 1932 (BUCA [27]).
- Prokhanov, J.* 436 (LE [14a]).
- Prokhorov, N. & Kuzeneva, O. I.* 268 and 772 (LE [15a]).
- Prudeucishha, A.* 22 (COI [18]).
- Przewalski* s.n. 30 May 1869 (LE [11]).
- Puech, M.* s.n. May 1867 (G [32c]).
- Punina* s.n. 25 July 1984 (LE [20c]), s.n. 25 Apr. 1985 (LE [20d]), s.n. 2 May 1985 (LE [27]).
- Purer, E. A.* 5022 (A [10]), 6618 (CAS, MO [10]).
- Purer, E. & Detmers, F.* 16362 (A [10]).
- Purpus, C. A.* s.n. California, Mendocino CO: Patter Valley (A [9]).
- Purtskvanidze* s.n. 22 May 1948 (TBI [20g]).
- Qianbei Exped.* 0115 (HGAS, PE [15a]).
- Qianxi Exped.* 205 (PE [15a]).
- Qing, Z. Y.* 1218 (HNWP, PE [14b]).
- Qinghai-Tibet Exped.* 14845 (PE [2]).
- Qinghai-Xizang Exped.* 750450 (KUN, PE [1]), 201, 73–294, 107–46, 11458 and 14082 (PE [2]), 1878, 2209, 7673 and 11795 (KUN, PE [2]), 73–294 (PE [13]).
- Qinghai-Xizang Exped. Vegetation Group* 9893 (PE [14b]).
- Qinling Exped.* 182 (PE [15b]).
- Qinlong Exped.* 972 (PE [15a]).
- Qiu, B. Y.* 55307 (PE [2]), 51019, 51880 and 57101 (KUN [2]).
- Qiu, J. Z.* 8901 (PE [3b]), PB88022, PB88028, PB88027, PB88030, PB88031, PB88032, PB88033, PB88035 and PB88601 (PE [4a]), PB88302 (PE [5]), PB89201 and PB89501 (PE [6]), PB88018, PB88021, PB88022, PB88023 and PB88305 (PE [7]), PB88402, PB88403 and PB88501 (PE [15a]), PB85090, PB85091, PB88016, PB88017, PB88018, PB88019, PB88020, PB88022, PB88101, PB88103, PB88104, PB88105, PB88106, PB88201, PB88202, PB88203, PB88301, PB88302, PB88305, PB88501, PB89301, PB89401, PB89501, PB89601 and P1–P7 (PE [15b]), PB89101 and PB89102 (PE [22]).
- Qiu, Zhu, Deng & Shi* 66–023 (CPB [2]).
- Qu, Z. X.* 2792 (PE [14b]).
- Quik, R. C.* s.n. 15 June 1933 (CAS [9]).
- Radde, G.* s.n. 1858 (LE [15a]).
- Raik* 194 (B [27]).
- Ramsey, H. J.* 371, 372 and 2723 (A [10]).
- Rashid, A., Nasir, E. & Stewart, R. R.* 25551 (W [12]).
- Ratcliff, T.* s.n. 10 May 1982 (MO [9]).
- Raven, P. H.* 17993 (A [9]).
- Raven, P. H. & Thompson, H. J.* s.n. 5 May 1959 (A [10]).
- Raven, P. H. & Thorne, R. F.* 19026 (A [10]).
- Rebollar, G. et al.* s.n. 18 June 1976 (MA [32e]).
- Rechinger, K. H.* 12345 (BM, G, W [19a]), 13726 (US, W [19a]), 11678 (E, W [21a]), 61996 (G, MA, W [21a]), 17105 (G [21c]), 22478 (GZU [29]).
- Rechinger, K. H. & F.* 8144 (BM [19a]), 3889 (LD [21a]).
- Recher* s.n. 1867 (LE [27]).
- Reed, F. M.* 1259 (F [10]).
- Refet* s.n. June 1881 (BM [32d]).
- Reise* 511 (WU [30]).

- Reiser* s.n. 22 May 1893 (B, G, W [27]).
- Reiser*, O. s.n. Apr. 1890 (WU [28]).
- Reisser, Reisser*, M. s.n. 10 Apr. 1971 (W [19a]).
- Reitschneider*, O. s.n. 15 June 1955 (CAS [9]).
- Requien* s.n. 1822, s.n. 1849 and s.n. 1850 (G [17]), s.n. June 1827 (K [17]).
- Requien* s.n. FRANCE, Lozere (G [32c]), s.n. Apr. 1846 (G [32e]).
- Retz*, B. de 14784 (B [32c]).
- Reverchon*, E. 218b (F, K, P, WU [17]), 291a and 291b (E, K, P, WU [17]), 539a (B, E, G, GZU, P [18]), 539b (P [18]), s.n. June 1890 (B [18]), s.n. 9 Aug. 1889 and s.n. 13 May 1889 (E [18]), s.n. 15 June 1890 (G, WU [18]), s.n. June 1900 (B, E, G, GZU, P, WU [18]), s.n. June 1904 (G [18]), 3 (BM, E, G, P, WU [19a]), s.n. 24 May 1884 (BM, G, K, P, WU [19a]), 346 (BM, G, K, P, WU [24]), s.n. 13 May 1889 and s.n. 9 Aug. 1889 (E [24]), 96 (G, MPU, P, WU [25]), 324a and 324b (BM, CAS, E, F, G, K, LD, M, MA, MPU, P, WU [25]), 138 (BM [32c]), s.n. 7 June 1868 (K [32c]), s.n. 30 May 1872 and s.n. 11 June 1873 (WU [32c]), s.n. 27 May 1894 (G [32c]), 1273 (B, BM, E, GZU, W [32e]), 1446 (BM, E [32e]), s.n. May 1892 (BM, G, P, W [32e]), s.n. June 1892 (B, E, K, W [32e]), s.n. Aug. 1892 (B, E, G, K [32e]), s.n. June 1893 and s.n. 17 May 1894 (G [32e]), s.n. June 1894 (B, E, M, P [32e]), s.n. Aug. 1894 (B, E, P [32e]).
- Reverchon*, E. & *Derbez*, A. 256a, 256b and 258 (G, WU [32c]), s.n. 30 May 1887 (B, BM, E, G, GZU, K, RO, WU [32c]), s.n. 2 Aug. 1888 and s.n. 15 June 1888 (E [32c]).
- Reznichenko*, V. 49, 58, 106a, 106b and s.n. 11 June 1900 (LE [14a]).
- Reznichenko*, V. & A. 360 (LE [14a]).
- Riccavdi*, E. s.n. June 1898 (BM [32a]).
- Richard* s.n. May 1818 (G [32c]).
- Richter*, A. s.n. 13 May 1900 and s.n. 16 Apr. 1902 (B [27]), s.n. 23 May 1900 and s.n. 16 Apr. 1904 (GZU [27]), s.n. 14 May 1907 (G [27]), s.n. 4 May 1907 (B, BC, BM, E, G, GZU, P [27]), s.n. 16 June 1909 (B, BC, GZU [32a]).
- Richter*, L. s.n. May 1898 (B, E, TUB [32a]).
- Rico*, E. s.n. 11 Apr. 1981 (MA [32c]).
- Rigo*, G. s.n. May 1894 and s.n. June 1894 (B, BM, E, LD, WU [32a]), s.n. June 1897, s.n. 06.1900 and s.n. 6 June 1908 (LD [32a]), s.n. Apr. 1902 (B [32a]), s.n. June 1904 and s.n. July 1904 (BM, K, RO [32a]), s.n. 24 June 1914 (B, BM [32a]).
- Ripas*, P. B. s.n. 1910 (LE [11]).
- Riverd*, J. R320 (B [18]).
- Robert* s.n. 20 July 1871 (E [32d]).
- Robert*, T. & *Schling* 3013 (MO [10]).
- Rochel* s.n. 1835 (BM, BP [32b]).
- Rock* 16110, 16157, 22821, 24123, 24717, 24758, 24984 and 25179 (E [2]).
- Rock*, J. F. 12260, 12829 and 13127 (PE [14b]).
- Rodin*, R. J. 5451 (US [12]).
- Rodriguez Marzal*, J. L. s.n. 15 May 1999 (MA [24]).
- Roemer*, J. J. s.n. 1877 (BM [18]), s.n. RUSSIA, Terskaya: Caucasus and s.n. RUSSIA, Terskaya: Caucasus, ad littoral Wolga lecta (BM [27]).
- Rohderi*, I. s.n. 23 July 1960 (LE [14a]).
- Rollins*, R. C. 2990 (CAS [9]).
- Roma*, N. s.n. 18 May 1966 (BUCA [20a]).
- Romanova*, E. S. & *Lukjanova*, L. N. s.n. 23 June 1953 (LE [11]).
- Romero*, T. s.n. 16 June 1985 (MA [32e]).
- Roos*, J. 217 (A [10]).
- Roraris*, C. & *Mendes*, E. J. 812/1060 (COI [18]).
- Rose*, J. P. 1008 (MO [9]).
- Ross*, H. s.n. Apr. 1899 and s.n. June 1899 (BM [21d]), s.n. Apr. 1896 and s.n. June 1896 (B, P, WU [21d]).
- Ross*, T. & *Boyd*, S. 4237 (CAS [10]).
- Rothmalor*, W. s.n. 24 May 1938 (B [18]).
- Roux*, N. 545 (B, P [17]).
- Rouy*, G. s.n. 8 July 1885 (G [32c]).
- Rozhevits*, R. 55 (LE [26]).
- Rubin*, A. s.n. 28 July 1931 (LE [14a]).
- Rubin & Maskil* s.n. 18 Aug. 1932 (LE [14a]).
- Rubtsoff*, P. 9309 (CAS [9]).
- Ryndin* 50 (LE [11]).
- Rzazade* s.n. 21 Aug. 1938 (BAK [20e]).
- S Gansu Grassland Exped.* 681 (NWTC [14b]).
- s. coll.* 09, 1547 and 2133 (PE [2]), 275 and 1011 (SM [2]), 0573 (SM [4a]), s.n. 21 Apr. 1948 (A [10]), 3509, 3964, 4218, 7367, 7691 and 10034 (PE [11]), 368.5/713-2 and s.n. 6 June 1916 (LE [11]), 3867 (XJBI [14a]), 84, s.n. Aug. 1958 and s.n. CHINA, Gansu Prov., Lanzhou: Mt Tiandu (NWTC [14b]), 649 (SM [14b]), s.n. Aug. 1972 (CPB [14b]), s.n. 31 Aug. 1956 (PE [14b]), 116, 312, 451, 466, 0543, 869, 1967, 2117, 2339, 2572, 3348, 6544, 6549 and s.n. CHINA, Heilongjiang: Mao'er Shan (PE [15a]), 0331, 662 and 886 (SM [15a]), s.n. CHINA, Heilongjiang: Ning'an, Jiangshuijiao Forest Farm and s.n. CHINA, Heilongjiang: Shangzi, Weihe Distr. Datutouzi (IFP [15a]), 536, 34431 and 34768 (PE [15b]), 630 and s.n. 9 Aug. 1965 (SM [15b]), s.n. June 1898 (SOM [20a]), s.n. 3 June 1964 (TBI [20c]), s.n. 23 Aug. 1968 (TBI [20g]), 12605 (G [21a]), 0333 and 13034 (SM [22]), s.n. 13 May 1964 (G [23]), 780 and 7385 (XJBI [26]), s.n. 14 Aug. 1963 (LE [26]), *s. loc. ex Herb. Mus. St Petersburg* (US [27]), s.n. 1 May 1887 and s.n. 4 May 1887 (RO [32e]), s.n. 13 July 1941, s.n. SPAIN, Granada:

- Sierra de Harana and s.n. SPAIN, Tarragona: Sierra de Lardo (MA [32e]).
- Saiki, Y. 3076 (KYO [15a]).
- Saint-Lager s.n. 21 June 1898 (B [32a]).
- Sakharov 957 (LE [20g]).
- Salanus, R. s.n. May 1965 (G [32c]).
- Sallin, Y. A. 405 (LE [15a]).
- Salzmann 83 (G [32c]).
- Samaniego, N. M. s.n. 7 June 1989 (COI [18]).
- Sambuk, F. s.n. 31 July 1927 (LE [14a]).
- Sanadze et al. s.n. 3 Apr. 1960 (TBI [26]).
- Sanchez, J. s.n. 6 May 1976 (BAC [18]).
- Sanders, A. C. 21703 (CAS [10]).
- Sandor, M. D. s.n. 11 May 1913 (BP [32b]).
- Sanotzky, I. 15 (LE [15a]).
- Sanparoff 1849 (LE [11]).
- Sarandinaki, V. s.n. 18 July 1907 (BP [27]).
- Saryczewa, Z. & Berezovczuk, E. s.n. 20 May 1956 (K [27]) and s.n. 21 May 1956 (E, G, K, PE [27]).
- Sasgualo s.n. ITALY, Rasarno (RO [21a]).
- Sato, J. 10005 (PE [15a]), 3055 (IFP, PE [15a]).
- Sauer, W. 2361, 2365 and 4169 (SA [32a]).
- Sauer, G. & W. 12635 (SA [19a]), 27671 (SA [21d]), 24108, 31198 and 31212 (PE, SA [29]), 14571, 24369 and 34831 (SA [32a]).
- Savenkova, A. 29 (LE [26]).
- Saverkin, A. 272, 308 and 319 (LE [11]), 68, 753 and 820 (LE [15a]).
- Savich, N. 756 (LE [15a]).
- Savich, V. L. s.n. 16 June 1927 (LE [15a]).
- Savich, V. M. 38, 88, 456, 457, 824, 833 and 2004 (LE [15a]).
- Savulescu, T. s.n. 1 July 1943 (BUCA [28]).
- Sbapt s.n. 1 June 1883 (WU [32a]).
- Schacht, W. s.n. 15 Apr. 1959 (M [19b]).
- Schaefflein, H. 58-116 (GZU [32a]).
- Schiffers 342a (LE [27]).
- Schipchinsky, I. V. 652 (BAK [20e]).
- Schipczinsky 513 (LE [20e]).
- Schipczinsky, N. V. 92 (LE [11]), 125 (LE [26]).
- Schirajewsky, J. s.n. May 1905 (BM, BP [27]).
- Schkhian, A. s.n. 5 Apr. 1937 (TBI [20b]).
- Schmidt, F. s.n. June 1861 (LE [11]).
- Schmidt, F. & Glehn s.n. 18 June 1860 (LE [15a]).
- Schmidt, H. H. & Noyes, R.D. 789 (MO [9]).
- Schnader s.n. RUSSIA, Terskaya: Caucasus (LE [27]).
- Schneider, C. K. 175 and 595 (BM, K, WU [28]).
- Schoerer s.n. 1833 (BM [32a]).
- Sedakov s.n. RUSSIA, Chitinsky Prov. Nerchinsk (LE [11]).
- Sedelnikov, A. s.n. 8 July 1908 (LE [14a]).
- Segura Zubizarreta, A. 14.847 (MA [24]), s.n. 4 May 1961 (MA [21a]).
- Seifert, A. s.n. Apr. 1958 (M [19b]).
- Sejourné, A. s.n. 24 Apr. 1890 (P [21a]).
- Semjagin, M. E. 98c (LE [15a]).
- Sensinoff 235, 250, 335, 435 and 516 (LE [11]).
- Serbanescu, G. s.n. 22 May 1965 (BUCA [27]).
- Serdjukov s.n. 5 May 1964 (TBI [20g]).
- Sergeeva, T. 65 (LE [14a]).
- Sergienko s.n. 10 June 1973 and s.n. 20 June 1983 (LE [20b]).
- Sergievskaya, L. I. s.n. 25-26 June 1962 (LE [11]).
- Serpukhova, E. s.n. 28 Aug. 1926 (LE [15a]).
- Shanxi Exped. 496 (PE [11]), 684 (PE [14b]), 265 (PE [15b]).
- Shanxi Exped. Wang & Tian 594 (PE [14b]).
- Sharif 534 (W [20e]).
- Sharova s.n. 24 June 1940 (LE [20c]).
- Sharsmith, H. K. 3947 (A [9]).
- Sharya, R. R., Adlikari, M. R. & Subedp, M.N. 7904 (KATN [12]).
- Shchukin, S. s.n. June 1834 (LE [11]).
- Shchukin, S., Ledebour, Reliqu. s.n. June 1834 (LE [11]).
- Sheldon, E. P. 8347 (MO [9]).
- Shen, Y. T. 4860131 (XJNU [26]).
- Sheng, L. D. 64-113 (CPB [2]).
- Shestunov, N. 706 a (LE [11]), 23 (LE [15a]), 1275 (LE [20b]).
- Shevock, J. R. 5008 (A [10]).
- Shijiazuo Exped. 531 (PE [15a]).
- Shim, H. J. s.n. 28 July 1947 (SNU [15a]).
- Shimizu, T. 01937, 4328, 4652, 5018, 5815 and 5998 (KYO [15a]).
- Shinova & Kinzikaeva 1550 (LE [26]).
- Shishkin, B. s.n. 24 May 1914 and s.n. 1 June 1914 (LE [26]).
- Shishkin, I. 209, s.n. 10 June 1923 and s.n. 17 June 1923 (LE [15a]).
- Shliahtin, A. s.n. 8 June 1902 and s.n. 11 June 1911 (LE [14a]).
- Shrenk, A. s.n. 1840 (LE [26]).
- Shrestha, T. B. 4247 and 5238 (KATN, US [12]).
- Shreter, A. 587 (LE [15a]).
- Shteip s.n. 9 Apr. 1924 (LE [20b]).
- Shternberg, L. Y. 143 I (LE [15a]).
- Shukin, S. s.n. RUSSIA, Buryato-Mongolian Autonomous State, near Baikal (LE [14a]).
- Shuttleworth, R. J. s.n. June 1837 (BM [18]).
- Shverskaya s.n. 25 July 1930 (LE [11]).
- Sichuan Econom. Plants Exped. 071, 0735, 1383, 1914, 3363, 4431 and 4457 (PE [22]).
- Sichuan Econom. Exped. A59-0246, A59-1001, A59-1208, A59-2554, Ya-838 and (-59)2290 (PE [14b]).
- Sichuan Econ. Plants Exped.-Fuling Team (X. Zhang) 522 (SM [15a]).

- Sichuan Inst. Chinese Materia Medica Exped.* 56, 92, 99, 221, 237, 245, 296, 580, 639, 848, 853, 2130, 2191 and 2507 (SM [22]).
- Sichuan Pl. Coll.* 0905 (PE [14b]).
- Sidorenko* 185 (LE [26]).
- Simeonovski, M.* s.n. 7 Apr. 1968 (SOM [28]).
- Simkovics* s.n. 1 Apr. 1874 and s.n. 31 May 1874 (BP [32b]).
- Simkovics, L.* s.n. 20 July 1887 (BP [27]).
- Simpson, D. R.* 236 (F [9]).
- Sino-British Cangshan Exped.* 0684 (E, KUN [2]).
- Sino-German Exped.* 7179, 7692, 7693 and 8257 (PE [11]), 7476 and 7903 (PE [15a]).
- Sintensis, P.* 515 (G [28]), 1780 (G, K [30]) and 5591 (E, G, K, W [30]).
- Sintenis & Rigo* 352 (LD [21a]), 854 (BM, G [21a]).
- Siralev, V.* 151 (LE [11]).
- Siuzev, P. V.* s.n. 30 Aug. 1905 (LE [11]).
- Skalozubova, N.* s.n. 6 June 1895 (LE [14a]).
- Skaltsounis* 23478 (ATH [21c]).
- Smirnov, V.* 1936 (LE [14a]).
- Smith, A. M.* s.n. June 1869 (WU [32a]), s.n. 26 May 1870 (TUB [32a]).
- Smith, H.* 2499 (PE [14b]).
- Smith, H. H.* 4811 (F [10]).
- Snogerup, S. & B.* 8531 (LD, UPA [21a]).
- Snogerup, S. & Gustafsson, M.* 50641887 (LD [21c]).
- Snyder, M. S.* s.n. 25 Jan. 1897 (F [10]).
- Sochadze* s.n. 13 July 1958 (TBI [20g]).
- Sochadze, E. & M.* s.n. 25 July 1956 (TBI [20g]).
- Sochadze, M.* s.n. 6 Aug. 1955, s.n. 6 July 1957, s.n. 30 June 1958, s.n. 2 July 1958 and s.n. 6 July 1958 (TBI [20g]).
- Sochava* s.n. 1 Aug. 1946 (LE [20b]).
- Sochava, V.* 100 (LE [14a]), s.n. 13 July 1934 (LE [15a]).
- Sokolov, P.* 13a (LE [14a]).
- Sokolov (Sokolow), T. W.* 156 and 286 (LE [11]).
- Sokolova, E.* s.n. 20 June 1924 (LE [15a]).
- Soleirol* s.n. 15 May 1869 (G [17]).
- Solodko* s.n. 23 Sep. 1984 (LE [20g]).
- Solokhin, T. I.* 926 (LE [11]), 928 (LE [15a]).
- Solonova, E. & Shmeleva, L.* s.n. 31 July 1927 (LE [11]).
- Sommier, S. & Levier, E.* 47 (G [20c]).
- Sommier, S.* s.n. 12 Apr. 1872 (G [21a]), s.n. 1 July 1871 (G [32a]).
- Song, Z. P.* 38544 and 39107 (PE [14b]).
- Sonklar* s.n. 23 June 1872 (WU [32a]).
- Sonne, C. F.* 10 (MO [9]).
- Soó, R. de* 1240 (BP [32b]).
- Sosnin* s.n. RUSSIA, Nerchinsk (LE [11]).
- Sosnowsky, D.* s.n. 15 May 1917 (TBI [20c]).
- Spahr, G. H.* s.n. 29 Apr. 1954 (IDS [9]).
- Speshinova, E. S.* 4, s.n. 15 June 1909 (LE [15a]).
- Spitzenberger, F.* 165 (W [21a]).
- Spreitzenhofer, G. C.* s.n. 20 July 1882 (B, WU [19a]), s.n. 4 May 1877 (B, WU [32a]).
- St.-Lager* s.n. 19 June 1894 (K [18]).
- Stace, C. A. & Cotton, R.* 390 (BM [21d]).
- Stainton* 7536 (K [29]), 8328 (E [30]).
- Stamatiadou, E.* 17845 and 22668 (ATH [17]), 8113, 17797 and 19652 (ATH, BM [17]), 18809 (ATH, BM, E [17]), 6040, 6760 and 19894 (ATH [19a]), 17762 (ATH, BM [19a]), 5792 (ATH, BM [19b]), 2666, 6334, 22715 and 22724 (ATH [21a]), 6309 and 8307 (ATH, BM [21a]), 2736 (ATH, BM, E [21a]), 9179 and 19258 (ATH [21c]), 18237 (BM, E [21c]), 7778 and 18328 (ATH, BM [21c]), 19188 (ATH, BM, E [21c]), 12440 (ATH, BM, E [28]), 15209 and 19626 (ATH [28]), 22045 (BM [31]).
- Stanford, E. E.* 375 (A [9]).
- Stankov, S. & Pegova, A.* s.n. 23 May 1929 (LE [20a]).
- Staudinger, M.* 5507 (W [14a]).
- Steane* 6 (E [12]).
- Stearn, W. T.* s.n. 11 May 1976 and s.n. 12 May 1976 (BM [21c]).
- Stefani, J.* s.n. 13 July 1910, s.n. May 1919 (P [17]) and s.n. 13 July 1911 (W [17]).
- Steiner, E. & H. M.* 98 (W [20c]).
- Stepanenko & Kudriashova* 2514 (LE [26]).
- Stern, F. C.* s.n. 04.1936 (K [24]).
- Steup* s.n. 8 May 1923 (LE [20g]).
- Steuvot* s.n. 1830 (G [21a]), s.n. 1842 (P [21a]).
- Stevanovic et al.* s.n. 13 July 1998 (BGUB [32b]).
- Stewart, J. L.* 1871 (E [12]).
- Stewart, R. R. & Nasir, E.* 387 (US [12]).
- Stocken, C. M.* 35964 (E [18]), 35864 (E [24]).
- Stojanov, N.* s.n. 24 May 1931 (SOM [28]).
- Stojić, V.* s.n. 7 May 1996, s.n. 7 June 1996 and s.n. 10 May 1997 (NSAD [32b]).
- Stoyalov, L. & Kitalov, B.* s.n. 13 June 1952 (SOM [28]).
- Stoyanov, E.A.* 167 (LE [11]).
- Strechey & Winterbottom* 1 (P [12]).
- Stribný, V.* s.n. 4 July 1896 (B [28]), s.n. 16 May 1896 (G [28]) and s.n. May 1910 (BM [28]), s.n. June 1914 (SOM [28]), s.n. May 1916 (E [28]), s.n. May 1892 (WU [28]), s.n. June 1897 (B, G [28]).
- Strid & Papanicolaou* 15143 (G [19a]).
- Strob, P. G.* s.n. 3 June 1873 (WU [32a]).
- Strobl, P. G.* s.n. Apr. 1873 (K, RO, WU [21d]), s.n. 23 June 1873 (WU [21d]).
- Stschukin (Shchukin)* s.n. RUSSIA, Chitinsky Prov., Nerchinsk (LE [11]).
- Stuchenberg* 15 (LE [27]).
- Stukov, G. A.* 542 and s.n. 1 Sep. 1904 (LE [11]).
- Sugimoto, J.* s.n. JAPAN, Shizuoka: Izu, Kono and s.n. JAPAN, Shizuoka: Mukadake (KYO [15a]).

- Suhareva*, A. s.n. 11 June 1911 (LE [14a]).
- Sukachev*, V. s.n. 15 June 1909 (LE [11]).
- Sukachev*, V. & *Poplavskay*, G. I. 1377, 2220 and 3199/825 (LE [11]).
- Suksdorf*, W. N. 6965 (MO, US [9]), 13950 (F, MO, US [9]).
- Suzuki*, Z. s.n. JAPAN, Fukushima: Nishishiragawagun, Nishisato-mura (KYO [15a]).
- Szovits* (*Szovitz*) s.n. ARMENIA (US [20b]), s.n. ARMENIA (WU [20c]), s.n. ARMENIA (E [27]).
- Takaheshi*, H. & *Takano*, H. 7313 (KYO [15a]).
- Takahoshi*, M. 1562 (KYO [15a]).
- Takee*, G., *Abumiya*, H. & *Hoshiro*, Y. s.n. RUSSIA, S Sakhalin: Mt Kasipo (SAPS).
- Tang*, T. 938 (PE [14b]), 2074 (PE [15a]), 963 (PE [15b]).
- Taohe Exped.* 3243 (PE [14b]).
- Taquet* 916, 4104 and 4942 (E [15a]).
- Tashiro* s.n. JAPAN, Yamashiro, Taizizan (KYO [15a]).
- Tashiro*, Z. s.n. JAPAN, Oita: Mt Kurodake, s.n. JAPAN, Fukui: Aobayama, s.n. JAPAN, Oita: Kujuzan, Hokain, s.n. JAPAN, Oita: N Oita, Yufudake, s.n. JAPAN, Oita: Yufudake and s.n. JAPAN, Saga: Tachodake, N of Saga city, (KYO [15a]).
- Taskin*, A. s.n. 15 June 1912 (LE [11]).
- Tatarowa & Borsowa* 52 (LE [26]).
- Taylor*, J. & C. 15609 (MO, US [10]).
- Taylor*, M. S. 3927 and 3996 A (MO [9]).
- Téllez*, R. s.n. 6 Apr. 1983 (MA [18]).
- Temnoev*, N. s.n. 5 July 1930 (LE [14a]).
- Temperate Forest Exped.* 075 (PE [15a]).
- Templeton*, B. s.n. 26 Apr. 1939 (A [10]).
- Temprano*, E. 40 (MA [32c]).
- Teplonkhov*, T. s.n. 3 June 1893, s.n. 20 July 1895 and s.n. 28 July 1895 (WU [14a]).
- Teploukhov*, F. 355 (LE [14a]).
- Tepnner*, H. s.n. 2 June 1963 (GZU [30]).
- Terentjeva*, E. M. s.n. 12 Aug. 1912 (LE [11]).
- Thalsz*, L. de s.n. 29 May 1913 (BP [32b]).
- Thomas*, H. s.n. 1893 (G [32a]).
- Thomas*, J. H. 6496 (CAS [10]).
- Thompson*, J. W. 1150 (US [9]), 6194 and 10433 (MO, US [9]), 4178 and 11510 (CAS, MO [9]).
- Thorne*, R. F. 41429, 42717 and 54010 (A [10]).
- Thorne*, R. F. & *Carolyn*, R. 41623 (A, MO [10]).
- Thorne*, R. F. & *Lathrop*, E. W. 33329 (CAS [10]).
- Thorne*, R. F. & *Tilforth*, C. W. 38176 (A [10]).
- Thuret*, G. s.n. 14 May 1860 (P [32c]).
- Tian*, X. H. & *Zhang*, L. T934001 (PE [22]).
- Tilforth*, C. W. & *Wisura*, W. 1770 (A [10]).
- Tillet*, P. s.n. 6 Apr. 1879 (G [17]), s.n. SYRIA: Slenfi (G [23]).
- To*, B. S. 2234, 10012 and s.n. May 1917 (SNU [11]), 4322, 8730, s.n. 22 Aug. 1935, s.n. 17 May 1936 and s.n. Aug. 1937 (SNU [15a]).
- To*, B.S. & *Shim*, H.T. s.n. 15 July 1933 (SNU [11]).
- Tobey*, C. 101 and 944 (E [20a]), 1230 (E [30]).
- Togasi*, M. 1288 (KYO [15a]).
- Tolmachev*, A. s.n. 19 May 1939 (LE [15a]).
- Tolmatschew*, I. 247 (LE [14a]).
- Tomin*, M. P. 28b, 29b and 67 (LE [14a]).
- Tong* 114 (E [30]).
- Topa*, E. s.n. 9 Aug. 1948 (BUCA [20a]), s.n. 5 July 1967 (BC, WU [27]).
- Torba* 31, 684 and 834 (LE [15a]).
- Torii*, K. s.n. JAPAN, Aichi: Toci-cho (KYO [15a]).
- Townsend*, C. C. 71-89 (K [21a]).
- Transhel*, V. 371, 373 and 495 (LE [11]), 330, 376 and 1223 (LE [15a]).
- Trelawny*, J. & *McPhail*, J. 2031 (E [21a]).
- Trigoni*, M. 79 (LE [15a]).
- Tripolitova*, T. s.n. 05-20 May 1915 (LE [26]).
- Trivaldsky* s.n. UKRAINE, Crimea: Sudak, Karadag (BP [27]).
- Troitsky*, W. s.n. 11 June 1913 (LE [14a]).
- Troyer* s.n. 29 May 1891 (GZU [32a]).
- Tsai*, H. T. 50441 (PE [15a]).
- Tschaidze*, I. s.n. 9 July 1957 (LE, TBI [20c]).
- Tshikvaidze* s.n. 25 Mar. 1965 (TBI [20b]).
- Tsoong*, K. K. 284 (PE [15a]).
- Tsoong*, P. C. 5004, 5024 and 8842 (PE [14b]), 4090 (PE [15a]).
- Tsui*, Y. W. 820 (PE [11]).
- Tu*, T. H. 362 and 4329 (PE [14b]).
- Tucker*, H. M. 573 (IDS [9]).
- Tugarinov*, A. s.n. 7 June 1912 (LE [14a]).
- Tulajkof*, S. & *Dolgopolo*, B. 141 (LE [11]).
- Turczaninov* s.n. 1831 (K, LE [11]), s.n. 1830 (LE [14a]).
- Turland* 307 (BM [21a]).
- Turland*, N. s.n. 23 Apr. 2003 (MO [19a]).
- Turner*, J., *Ball*, F. M. & *Blake*, C. 1293 (A [10]).
- Tuzson*, J. s.n. 26 June 1911 (BP [32]b).
- Twisselman*, E.C. 2511 and 15167 (CAS [10]).
- Tzanoudakis*, D. 1365 (GZU [17]), 6122 (GZU [19a]), 1387, 2257 and 10894 (UPA [21a]), 1205 (GZU, UPA [21c]), 1220 (G, UPA [21c]), 1402 (G, GZU, UPA [28]), 2222 and 2266 (GZU, UPA [28]).
- Tzeker* 56 (LE [27]).
- Ueda*, K. 489 (KYO [15a]).
- Uhanov* s.n. 15 Apr. 1930 and s.n. 19 Apr. 1930 (LE [20b]).
- Untchi* s.n. 4 June 1895 (GZU [32a]), s.n. 22 May 1899 (E [32a]).
- Urumov* s.n. 1890 (WU [28]), s.n. 1896 (SOM [28]).
- Urumov*, I K. s.n. 1904 (SOM [20a]).

- Ussher, C.B. 61 (K [21a]).
- Vajda, L. s.n. 22 June 1937, s.n. 26 May 1938 and s.n. 27 May 1938 (BP [20f]), s.n. 29 May 1931 and s.n. May 1935 (BP [32b]).
- Vale, F. s.n. 27 Apr. 1977 (MA [24]).
- Varentsov, V. s.n. 27 June 1913 (LE [14a]).
- Varpakhovsky s.n. 15 June 1909 (LE [11]).
- Vašák, V. s.n. 30 July 1977 and s.n. 12 May 1991 (W [20a]), s.n. 8 June 1976 (W [20b]), s.n. 30 May 1974 (G [26]), s.n. 20 July 1973 (W [26]), s.n. 29 July 1977 (G, W [27]).
- Vašák, V. & Vězda, A. s.n. 8 June 1978 (W [20b]).
- Vasilchenko 476a and 417 (LE [27]).
- Vasiljev s.n. 28 June 1923 (LE [15a]), s.n. 7 May 1948 (LE [27]).
- Vasiljev, V. N. 409 (LE [15a]).
- Vasiljev, V. N. & Gorelkina, M. V. s.n. 15 July 1952 (LE [11]).
- Vasiljev, V. N., Volkova, E. V. & Gordeeva, T. N. s.n. 26 June 1951 (LE [11]), s.n. 16 June 1951 (LE [15a]).
- Vasiljev, V. N., Volkova, E. V. & Ivanina, L. I. s.n. 7 June 1950, s.n. 16 June 1950, s.n. 6 June 1951 and s.n. 18 June 1951 (LE [11]), s.n. 23 May 1950, s.n. 24 May 1950, s.n. 4 June 1950 and s.n. 25 Aug. 1950 (LE [15a]).
- Vekilunov 32 (LE [20b]).
- Velasco, E. s.n. 20 Mar. 1976 (BC [16]).
- Verdrount, B. 4465 (K [32c]).
- Vereshagin, V. 296 and 345 (LE [14a]).
- Verhovskaya, V. & Mishin, M. 104 (LE [14a]).
- Veselsky s.n. 1861 (BM [32a]).
- Vicioso, C. s.n. June 1914, s.n. July 1916 and s.n. 30 June 1942 (MA [18]), s.n. 2 June 1931 (MA [24]).
- Vicioso, C. & Ceballos, L. s.n. 16 May 1931 (MA [24]).
- Vierhappz, F. s.n. 13 July 1931 (WU [27]).
- Vincent, M.A. 8518 (CAS [9]).
- Visloukh, I.K. 73 (LE [14a]).
- Vladimirov s.n. 15 June 1909 (LE [11]).
- Volkova, E.V. & Ivanina, L.I. s.n. 8 Aug. 1950 (LE [15a]).
- Von Minkwitz, Z. 1190 (LE [26]).
- Vorobjov, D. 155 (LE [11]), 37, 250, 419, 490 and 1120 (LE [15a]).
- Vydrin, A. s.n. 3 June 1908 (LE [14a]).
- Wagenitz, G. & Wraber, T. 91 (B [32a]).
- Wagner, J. s.n. Aug. 1898 (BC [27]), s.n. 2 May 1896 (BP [27]), s.n. May 1896 (G [27]), s.n. 12 May 1896 (BM, E, G [27]), 5 (BM, G, WU [28]), s.n. 9 May 1896, s.n. 24 Apr. 1908, s.n. 25 Apr. 1908 and s.n. June 1908 (BP [32b]), s.n. June 1909 (W [32b]), s.n. Apr. 1918 (BM [32b]).
- Wainwright, C. & DeBuhr, L. 590 (A [10]).
- Wakabayashi, M. 308 and 801 (KYO [15a]).
- Wakabayashi, M. & Naruhashi, N. 117 (KYO [15a]).
- Walker, M. s.n. 8 May 1975 (IDS [9]).
- Wallfisch, R. s.n. 2 May 1966 (BUCA [20a]).
- Wan, S. P. 750150 (PE [15a]).
- Wang & Zhou 19 and 198A (HNWP [14b]).
- Wang, C. S. 4340 (IFP [15a]).
- Wang, C. S. et al. 1086 (PE [11]), 1239 (IFP [15a]).
- Wang, C. W. 65523, 66335, 68199, 70489 and 70907 (PE [2]), 66617 and 70211 (KUN, PE [2]), 60273, 60905 and 61885 (PE [15a]).
- Wang, F. T. 22930 (PE [14b]).
- Wang, G. Z. 408 (IFP, PE [15a]).
- Wang, H. C. 896 (PE [2]).
- Wang, J. Q. 197 (NWTC [14b]).
- Wang, M. J. 285 (PE [15a]).
- Wang, Q. R. 1869, 7034 and 7270 (NWTC [14b]).
- Wang, S. X. 1065 (HNWP [14b]).
- Wang, S. Y. H97001 (MO, PE [6]).
- Wang, S. Y. & Wang, Y. Z. 94002 (PE [4a]).
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- Wang, T. P. 4594, 5343, 6944 and 15240 (PE [14b]), 1588, 4227 and 16283 (PE [15b]).
- Wang, W. et al. 1521 (IFP, PE [15a]).
- Wang, W. 560 (HIMC [11]), 690 (IFP [15a]).
- Wang, W. T. 2531 and 2699 (PE [15a]).
- Wang, W. Y. 26771, 26818 and 27060 (HNWP [14b]).
- Wang, W. Y. et al. 27347 (HNWP [14b]).
- Wang, X. L. s.n. CHINA, Yunnan, Lijiang: Sixth Distr. (CPB [2]).
- Wang, Y. WY06078-LTP, WY06079-LTP, WY06074-XCP, WY06075-XCP, WY06087-YYP, WY06082-NLP, WY06066-XGLLP, WY06067-XGLLP, WY06062-XGLLP, WY06063-XGLLP, WY06064-XGLLP (PE [2]), WY06051-MEKP (PE [3a]), WY06056-MXP, WY06058-MXP, WY06060-LXP, WY06061-LXP (PE [3b]), WY06031-TSP, WY06033-TSP, WY06096-HXP, WY06094-LYP (PE [4a]), WY06020-TBP, WY06012-TCP, WY06029-HSP (PE [4b]), WY06038-HYP, WY06000-JSP, WY06001-JSP, WY06002-JSP, WY06004-YJP, WY06006-YJP (PE [6]).
- Wang, Z. 1998 (PE [11]).
- Wankow, J. s.n. 18 May 1910 (B [20a]), s.n. 26 Apr. 1913 (K [20a]).
- Warpakhowsky s.n. 15 June 1909 (LE [15a]).
- Watanabe, S. s.n. JAPAN, Fukui: Imatatsu-gun, Ikedamura, Hekozan (KYO [15a]).
- Weber, W. A. 8372 (A, CAS, W [9]).
- Welwitsch 18 (COI [18]).
- Wendelbo, P. & Assadi, M. 18544 (W [20e]).
- Wendelbo, P. & Cobham 14322 (W [20e]).
- Wendelbo, P. & Shirdelpur 11668 (E, W [20e]).
- Werff, H. van der 12946 (MO [10]).

- Wettstein*, F. s.n. 28 Apr. 1918 (WU [32a]).
Wettstein, O. s.n. 3 June 1911 (WU [32a]).
Wetzchky, M. s.n. 1899 (G [20a]).
Wheeler, L. C. 477 (A. [10]), 452 (A, CAS [10]), 9189, 9226, s.n. 20 May 1970 and s.n. 8 June 1975 (F [10]).
White, J. W. s.n. 25 Apr. 1903 (E [16]).
Whiteford, C. 111 (BM [19a]).
Wiegand, M. C. & *Upton*, G. B. 3264 (F [10]).
Wiendlmayr s.n. May 1866 (B [32a]).
Wierzbicki s.n. SERBIA, Banat, between Ulma and Grebenacz, 11 May 1840 (BM, E, G [27]), s.n. SERBIA, Banat, between Ulma and Karlsdorf, 11 May 1840 (G [27]), s.n. ROMANIA: Banat: Oravica (GZU [27]), s.n. 10 May 1840 and s.n. May 1841 (E, K, W [32b]).
Wiggins, I. L. 1855, 2377 and 21649 (CAS [10]).
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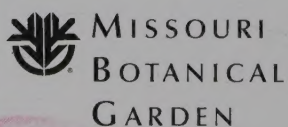
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HONG De-Yuan's new monograph of the popular genus *Paeonia* is a comprehensive taxonomic revision, based on extensive field observations, population sampling, and examination of more than 5,000 specimens. Detailed species descriptions are enhanced by 78 line drawings and 39 maps. This is an essential reference for taxonomists, growers, breeders, and horticulturalists.



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ISBN 978-1-84246-392-5

